The North Pickering Project

Environmental Management Opportunities and Constraints Within the North Pickering Site

August, 1975

Ministry of Housing
Ontario

This report was prepared as background material in the planning of The North Pickering Planning Area and does not necessarily constitute a recommendation of the Ministry of Housing nor approval of the Government of Ontario.

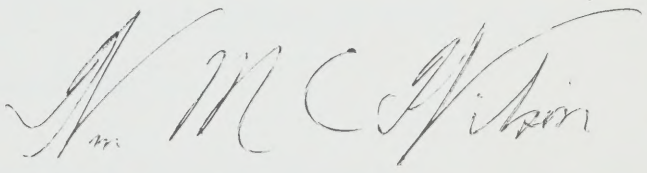
Environmental Management Opportunities and Constraints Within the North Pickering Site

PURPOSE

The strategies proposed in this document have evolved from previous environmental assessment activities. They relate to the structure and functions of a management programme for the implementation of the North Pickering Project environmental goals and objectives. This document proposes to guide the management of physical site resources, suggest the organization of interested public institutions and act as a reference in detailed planning and assessment.

ACKNOWLEDGEMENTS

The information compiled in this document is, for the most part, the product of Ecoplans Ltd. of Waterloo, J.F. MacLaren Ltd. of Toronto and London, Horton Forestry Services Ltd. and the Ontario Ministry of the Environment.



W.M.C. Wilson
August 31, 1975

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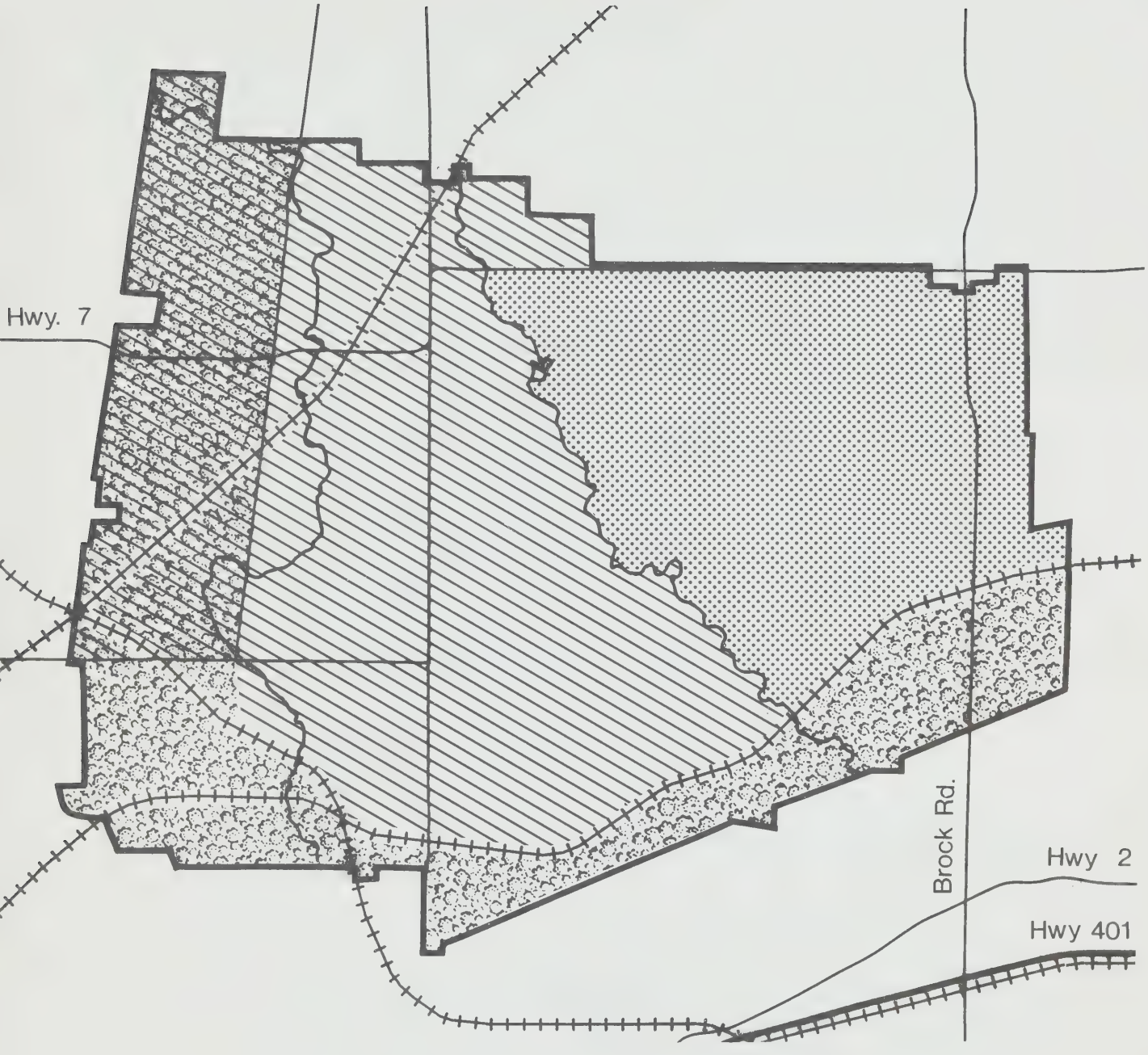
BACKGROUND

Since mid-1972, the North Pickering Project has undertaken an intense programme of environmental assessment and planning in co-ordination with other technical areas of planning. The process of environmental assessment has provided the Project with an awareness of the unique natural and cultural assets of the planning area and some insight into the character of that uniqueness. A conceptual planning process has placed this knowledge of site uniqueness into the context of the Project's principle planning objective, that of developing and implementing a plan for a new community.

The planning and assessment of natural and cultural assets has now evolved to a point where a distinctly new type of process must now take precedence--that of environmental management and detailed site planning.

General public preferences and governmental judgements, based in part on environmental planning, have set the broad pattern for probable future development of the 25,000 acres that is the North Pickering site. This broad pattern envisages three distinct sectors for detailed planning, development and management--the Open Space System, the agriculturally-oriented planning area and the urban-oriented planning area on the east of the West Duffin Creek. (See Map 1) It now remains for the Project to focus attention, in terms of environmental concerns, upon more detailed management and development strategies and in particular upon that area of the site intended for principally urban uses.



Map No.1

Three Planning Sectors

0 1 2 3 4 Km

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Open Space System

Urban Space

Agricultural Area

PLANNING PARAMETERS

Assuring that environmental quality issues are incorporated into the planning process for a new community requires the identification of a number of inter-related steps which might be outlined as follows:

1. Developing environmental quality goals specific to the site which consider regional eco-systems as well as on-site eco-systems, and sub-catchment (portions of watersheds) in regard to modelling of water quality and quantity;
2. Undertaking field investigations of existing geological, soils, vegetation, wildlife and archaeological/historical features;
3. Developing perspective of how these above-listed resources have changed over time because of human intervention and/or natural processes;
4. Developing environmental planning standards;
5. Anticipating eco-system responses to various general and specific development proposals, or environmental impact.
6. (a) Beginning, as soon as possible, renovation of natural systems deteriorated due to past human management or mismanagement;
   (b) Increasing stability of vegetative systems by encouraging diversity so that deleterious urban effects, such as salt along roads, heat island effect, or gaseous wastes, can be minimized;
7. Identifying environmental design and construction guidelines for controlling and reducing off-site or downstream effects due to poor quality storm water, increased urban runoff, or to gaseous waste generation.
8. Monitoring eco-system "health" (structure and function) to anticipate, in time, undesirable trends for remedial action;
9. Identifying cost implications for a management task force;
10. (a) Identifying institutional mechanisms and manpower needs to assure that decisions affecting environmental quality are made in accordance with seasonal cycles and with respect to the special biological needs of various species of trees and animals which in total make up an eco-system;
    (b) Developing community appreciation of existing natural and historical landscape elements;
    (c) Allowing for continual community participation in issues of environmental quality, as opposed to a reactive or an issue-oriented approach
    (d) Policy implications for the above (a), (b) and (c).

The following chapters elaborate upon the above ten major planning parameters to the extent which they already have been achieved or in terms of strategies for their future achievement.

The similarity between the above steps and the traditional planning process is not coincidental. The planning process, stripped to its essentials includes continuing survey, analysis, goals achievement, alternative evaluations, design choices and implementation. It is a universal problem solving process. Any problem, such as how to integrate 'environmental' values into a new community which is approached with these essentials takes on a solution characteristic of most sound and humane solutions. That is, an on-going process of implementation subject to a continous change and refinement in response to shifts in societal values.

ENVIRONMENTAL QUALITY GOALS

The goals and objectives which have guided the environmental planning team have experienced several changes since 1972. The present goals and objectives (see appendix I) are a result of assessments during the four conceptual planning phases and an increasing awareness of the site's natural and cultural resource systems.

Although originally based mainly upon the principle of diversity, (the maintaining and enhancement of a varied eco-system or eco-systems in a stable environment capable of withstanding temporary or long-term minor changes) the present goals and objectives have been refined into the form of planning and management strategies which could serve the principles of productivity (e.g. agriculture) and cyclicity (e.g. temporary storm water retention) as well.

ENVIRONMENTAL PRINCIPLES

Consistency in any program is achieved through the expressed basis in theory or principles used. As goals and objectives are expected to change with time, the assumed principles provide a constant point of reference for a program. At North Pickering the following principles are recognized:

Diversity

Diversity recognizes that in North Pickering as in any site-region, there exists a variety of natural species and man-made artifacts which form dynamic ecosystems or settlement areas. These systems are recognized as valuable in a scientific ecosystem snese by experts (watersheds, etc.) and in a symbolic sense by the public (significant areas for recreation, leisure, etc.).

Productivity

The existing ecosystems of North Pickering exhibit character-istics and potential for continued production of natural resources (trees, fish) and agricultural commodities (food) which may be maintained and enhanced.

Cyclicity

The health of diversde and productive ecosystems depends upon the stabilization or renewal of essential components (soil, nutrients, water) through such practices as erosion control, crop rotation and storm water detention.

Management

Advanced management activities which precede and coincide with construction will ensure that diversity, productivity and cyclicity are maintained in a manner which relates in a positive way to economic and social needs of the new community and region.

OVERVIEW OF RESOURCE SURVEYS, FUTURE SURVEY REQUIREMENTS AND SYNTHESIS OF MAJOR ENVIRONMENTAL FEATURES

The following description is based upon several site surveys which have been summarized by the Project.[1] General design implications are briefly mentioned as they are suggested by the nature of the terrain i.e. its capability, uniqueness or suitability for various types of uses.

Open Space System

The Open Space System, defining the southern and western boundaries of the site offers several environmental opportunities. (See Map 1) First, this open space corridor distinctly separates the proposed new community from Metropolitan Toronto to the west and south. Utilities such as hydro lines and pipelines, can be confined to the corridor and so reduce the number of swaths cutting through the site maximizing the use of the land for housing, commercial, and industrial purposes. Some moderate construction difficulties, however, may be encountered with the high ground water table and boulder pavement in the section west of the West Duffin valley to the Markham-Pickering Town line.

The orientation of the Open Space System in the south serves to connect the major river valleys by an east-west linkage, which greatly increases open space design possibilities for pedestrian and cycle paths. An open space corridor also affords other recreational possibilities, such as the proposed major regional park complex immediately north of the Toronto zoo and Beare landfill site to take advantage of the Rouge and Little Rouge river valleys and associated forest. The high water table zone west of West Duffin Creek could be developed for waterfowl ponds and possibly a cold or warm water fishery. The utility corridor could be managed for wildlife production by selective planting of food and cover species compatible with utilities operation and maintenance. As well, suitable portions could be put into agricultural uses, such as allotment gardens, specialty market garden crops, grazing, sod farming, and forest nurseries.

The possibility of organizing "agricultural condominiums" in this zone might be considered. A small cluster of houses (fully or partially serviced) with farm plots as part of the ownership pattern would allow urban-based people some exposure to specialized types of agriculture or more labour-intensive types of agriculture. By pooling their capital, these residents could afford a farm manager (perhaps a retired farmer), livestock, buildings, and equipment. If expertly done, the social value of this concept would improve community cohesiveness and transmit agricultural knowledge and value systems to urban people by mixing ages and skills.

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1 Environmental Planning: An Approach to Environmental Analysis, Plantown Consutlants, October 1974.

Agriculturally-Oriented Planning Area

The predominant environmental feature of this planning sector between the Open Space System and the West Duffin Creek valley is the high quality agricultural soils. This quality factor is the major constraint to urban development here. As a first priority the opportunity for encouraging more intensified and diversified agricultural activities, as mentioned above for the Open Space Belt, should be further investigated in an effort to realize the full natural potential of this planning area.

Road intrusions and upgrading of existing rural roads in this planning sector must be carefully handled so that movement of farm machinery and livestock is not unduly affected. Movement of Metro traffic to the new community and points east and north should be discouraged.

In this sector, several archaeological sites, particularly those adjacent to the Little Rouge and Petticoat Creek valleys are a valuable "non renewal" resources and represent much opportunity for pre-historic learning. Several hamlets, including Cherrywood, Green River, Locust Hill, and Cedar Grove, continue to provide rural flavour. The Mennonite complex at Steeles Avenue and the Markham-Pickering townline represent only a few of the architecturally significant buildings in the sector. It is possible that stream planting could be increased and agricultural runoff could become more controlled, thereby improving quality conditions.

Urban Orientated Planning Area

The river valleys of the West Duffin and East Duffin tributaries are the major physical constraints faced by the development of the site. Over time, the rivers have cut deep valleys into the glacial deposits, forming slopes too steep for development. These slopes as well are usually forested. The vegetation provides good wildlife habitat. Keeping the water in the creeks cool and of good quality provides habitat for cold water fish species. To maintain such quality, special consideration must be given to the problem of treating storm water drainage before allowing it into these streams. The steep forested slopes also provide interesting views.

The sum total of all these inter-related factors suggests that the river valleys remain untouched and storm water quality controlled. Thus the amount of developable land is reduced. Other physical constraints of this planning area include ground water recharge areas, scattered woodlots and marshes on the tableland, abandoned pits, and the Lake Iroquois shoreline with its corresponding boulder pavement below it.

The village of Whitevale and other concentrations of buildings of historical or architectural value (such as along concession road 5) are cultural constraints. Identified archaeological sites scattered in this planning area are also of research interest.

Many of these environmental features provide interesting and challenging design opportunities. The river valleys have potential for recreation open space corridors and for preservation of nature in the heart of a new community. Aesthetic opportunities are present in the dramatic relief of the valleys and the possibility of the new lake. Woodlots present opportunities for design innovations, attractive backdrops, and neighbourhood recreational areas. The land above the Lake Iroquois shoreline provides excellent views southwards to Lake Ontario. The numerous abandoned gravel pits may serve not only as storm water retention areas, but also as wildlife (woodcock, shorebirds, waterfowl) and fisheries habitats.

Future Survey Requirements

The scale of resource mapping undertaken, because it is proportional to cost, must be phased in step with design needs. Generally, the following scales might be considered appropriate:

Study Sector	Community Conceptual Design at a scale of 1:25,000 or 1:10,000	Neighbourhood Design at a scale of 1" to 400'	Subdivisions or individual lot design at a scale of 1" to 40'
Surficial Geology and soils mapping	1" to 1320 ' 1:14,840	1" to 400' or 1" to 200'	same as previous scale
Treed Areas and Hedgerows mapping	1:25,000 (qualitative only)	1" to 400' (quantitative and qualitative)	individual tree numbered and identified as to survivability
Wildlife and Fisheries	Food chains identified, species present identified semi-quantitatively	same	same
Archaeological Resources & Historical Buildings	All sites examined and qualitatively rated	same	same
Water Quantity; Quality	Sampling stations- network established	same	same
Climatology	Existing network data analysed; new stations established	wind tunnel testing	wind tunnel testing

By and large, the above sequence of mapping and analysis has been followed for the design team in the conceptual planning process. Data for the neighbourhood and subdivison design levels will be gathered for soils and geology in the summer of 1975. Treed areas, originally quantitatively surveyed at the 1:25,000 scale, combine what is usually separated into a two-level analysis, first done qualitatively at 1:25,000, and then quantitatively at 1" to 400'. This sequence minimizes the "front-end" cost. Whenever the design arrives at the 1" to 40' level of detail, tree by tree tagging and tree by tree evaluation of treed areas impinged on by development should be undertaken. Such tree analysis costs $2 to $4 per tree, or twice that if data are computerized for design purposes. This analysis can be justified on economic grounds where the value of a tree is offset by a proportionate rise in property values, such as a $2,000 mark-up for a "treed" lot, or a $10 to $20 per square inch value of an urban tree. The $10 to $20 per square inch value is more or less the cost of replacement from equivalent nursery stock. Ethical and aesthetic grounds justify this analysis irrespective of cost.

REGIONAL OVERVIEW OF POTENTIAL VEGETATION: BEFORE AND AFTER NEW COMMUNITY DEVELOPMENT

The principle point to be made here is that in the next major planning "revolution" in land-use from agricultural to urban, a knowledge of past stresses on the site's natural systems assists us in determining the best way to restructure the natural and man-made environment so as to conserve as much as possible from the past. In essence, eco-systems for open space and small urban spaces can be selectively reconstructed to adapt to and stablize under new urban conditions.

To reconstruct the past vegetation communities by utilizing the site region maps of Angus Hills,[1] it is possible to identify the forest eco-systems that may have occupied the site prior to European colonization. Based upon his tables, the general vegetation was probably hard maple-beech-red oak-hemlock, assuming a "normal eco-climate" and "fresh" (or well-drained) soils. Spatially relating the present vegetation and the soils map for York and Ontario counties suggests the tablelands probably contained circa, 1900 a hard maple-beech forest intermixed with lesser amounts of hemlock and yellow birch on both well and imperfectly drained soils, precisely what Hills hypothesizes in his report. The present occurrence of hemlock patches in the valley lands suggests that hemlock stands might have been a more significant forest type following the many creek valleys on the site.

The "North Pickering Archaeology" report by Konrad et al[2] discusses the presence of white pine stands relating to archaeological sites. Since there is no soil limitation or climatic phenonmenon to explain the distribution of these stands, they most likely were the result of Indian farming practices as suggested in the Konrad report. The stands disappearance, though not precisely documented, probably occurred between 1790 and 1850.

After new community development, climatological modifications will occur. Since urban climate is generally a few degrees warmer and urban drainage is sufficient to produce drier soils, a significant shift in the new community climate to one similar in rural lands near Windsor can be expected. Since evapo-transpiration (combined water loss by those two sources) is increased in urban situations, a potential climax vegetation on tablelands would shift from maple-beech-red oak-hemlock composition to maple-beech-white/red oak-shagbark hickory, or white/red oak-shagbark hickory-juniper mixture.

The impact of the warmer climate on existing vegetation is that we can expect a general loss in hemlock, yellow birch, and

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1 Hills, G.A., The Ecological Basis for Land Use Planning, Res. RPT. 46, Ont. Dept. Lands and Forests, 1961.

2 Konrad, V.A., North Pickering Archaeology, Res. RPT. 4, North Pickering Project, Ontario Ministry of Housing, et al 1974.

basswood, and a gradual increase in incidence of oaks and ash on the uplands. Any reduction in cold air drainage down slopes or in valley lands because of fill deposited across ravines most likely will put stress on hemlock and yellow birch.

The widespread occurrence of white cedar and aspen in the bottom lands is probably the result of hydrological stress and possibly hydrogen ion stress (alkaline water) following land clearing operations, although the impact of this kind of stress has not been adequately studied in this region. Historically, cedar and aspen were not abundant circa 1800 in other parts of southern Ontario, compared to their present status. These species' ability to layer and tolerate alkaline drainage makes them better adapted to an agricultural watershed than mature hemlock-hardwoods would be. Preservation of the few magnificent hemlock stands near Clarkes Hollow probably will require the stablization of flow to prevent urban alkaline water from saturating the forest floor.

Impact of Pre-Caucasian Use of Lands

As alluded to in reference to archaeological sites, Indian agricultural practices may have been responsible for the large white pine trees and stands occupying the site around 1790. Since none of these remain, they appear to have no significance from a planning point of view. However, the rich archaeological sites do offer some constraints to development, or constraints because of the lead-time required to do a "salvage dig".

Impact of Caucasian Use of Lands

Without a systematic or detailed study of the historical ecology which might identify special market effects on timber and early agricultural land use, we can still surmise the following types of stress upon the natural systems on the site following Caucasian settlement:

1. Increased hydrological loading of the creek valleys, probably increasing the occurrence of white cedar and aspen,
2. Increased sediment transport,
3. Possible upward shift in pH in stream water,
4. Clearing of timber,
5. Selective removal of pine, oak, and possibly hemlock for bark as tannic acid,
6. Grazing and high-grading of forest stands,
7. Breakdown in continuity of forest cover along streams,
8. Exploitation of gravel pits,
9. Energy production from dams (Whitevale) causing a subsequent warming of Duffin Creek (west branch), and
10. Farm drainage.

ENVIRONMENTAL MANAGEMENT STANDARDS

From an environmental quality point of view, setting design standards in terms of units of housing per acre is not feasible. Although density per se affects bird population structure, runoff, ground water infiltration, evapotranspiration and survival of natural forest areas, it is the spatial arrangement of the building and natural components which seems to be more important than a strict number of units per acre. For example, even with a 5 per cent open space allocation in a neighbourhood, some natural features can be preserved, although a 10 to 15 per cent figure is, if not optimal, certainly preferable. Given the large amount of valley land, storm water renovation/recharge areas (old gravel pits), and designated open space linkages in the design concept, there will not be a short fall in percentage dedicated as non-buildable land.

Environmental quality standards, as they relate to wildlife, water quality and quantity, air quality, ground water and setback requirements are discussed below. They have evolved over a period of almost two years of assessment and three distinct stages of evaluation of conceptual plans (Phases II, III and IV).

Minimum Habitat Requirements for Wildlife and Fisheries

Because of their particular spatial requirements, certain wildlife species can be expected to be eliminated; others may decrease; others may show no change, while others will be favourably affected. Major faunal species falling into these four categories are listed below together with management suggestions.

Eliminated	Management Suggestions
Deer	As species requires too large a block of continuous range, no management is practical due to high-speed, heavily travelled highways, restricted feeding areas and dog harassment.
Porcupine	Control molestation by shooting, maintain major timber blocks, possibly restock for nature education.
Decrease in Density	
Hawks, Owls, Meadow Larks, Killdeer	Raptor management is not feasible to provide the old-field successions to produce sufficient mice, rabbit and small bird population within the built environment. Agricultural and buffer zones will provide a reduced amount of habitat. Reforestation of gravel pits, gree belt zones and

	stream valleys will partially offset loss of city habitat. For meadow larks and killdeer no management would seem to be necessary as they are abundant elsewhere.
Ruffed Grouse	None feasible.
Snowshoe Hare	None feasible.
Fox, Skunk	Denning areas could be protected, but no protection is suggested due to rabies danger.
<u>No Change</u>	
Robins, Mourning Doves	No management required, although planting coniferous cedar and windbreaks will provide more habitat in 20 years.
Pheasant	Encouragement of winter feeding programme.
<u>Favourably Affected</u>	
Starlings, Pigeons (Rock Dove), English Sparrow	Restriction of roosting areas in downtown by appropriate design of buildings to reduce fouling of park areas and sidewalks.
Cardinals, Juncos, Blue Jays, Chickadees, Nuthatches, Woodpeckers	Encouragement of backyard shrub plantings, winter feeding.
Woodchuck, other puddle ducks	Possible encouragement by providing nesting boxes and feed.

Although the list above are not "standards" in the usual sense of the word, some approximate wildlife production statistics may be helpful. Concerning waterfowl, if Whitevale Pond were used as a breeding centre, it could produce (with the provision of supplementary feeding and nesting boxes) 100 to 200 ducklings (mallards, teal, wood duck) per summer. Geese, already nesting at Plum Hollow Tree Nursery, could be encouraged at Whitevale Pond as well. Proximity to the airport creating a potential danger to aircraft flight must be considered carefully before encouraging waterfowl this far north on the site. Having similar waterfowl potential, the ponds along Finch Avenue are farther from the airport.

Leaving hollow trees in the park and open space areas should be encouraged, except in those areas where heavy public use may cause some hazard, however slight, should the trees fall during a storm. In this way a wider variety of mammals and birds which utilize holes for rearing young will be conserved.

After 15 years, the storm water retention areas, if they are vegetated with willow, or alder aspen will be favourable habitat for woodcock and ruffed grouse and many small insectivorous birds. If open gravel shorelines surrounding pools of temporary or permanent water were maintained in these retention areas, even if only 1 to 3 acres in size, many species of shorebirds would use these areas during migration.

Judicious backyard planting of coniferous and fruit-bearing shrubs, especially where cluster development and zero lot lines allow wider backyard linkage to wooded floodplain corridors, will provide habitat for a reasonable variety of bush and tree nesting birds, such as yellow warblers, tree sparrows, robins, doves, jays, chickadees, and hummingbirds. Zero lot-lines for housing adjacent to watercourses, either intermittent or permanently flowing, offer particular promise for widening the drainage easement, thereby providing habitat for a wide variety of birds. Such easements can serve, if planted as visual buffers, as bike paths and as walkways depending upon whether or not the easement includes public trespass.

If the combination of salmonid and warm water species is acceptable for West Duffin Creek, the dam could be used to regulate fall flow which would encourage salmon movement to the proposed hatchery. Such a hatchery could be built for between $100,000 and $250,000.[1]

As the Little Rouge is too warm for a salmonid fishery, this river should be managed for bass. Channel improvement, deepening some holes and digging of ponds alongside the stream for trout, would improve productivity. However, further fishery and geological study is needed to indicate what rehabilitation potential exists for a pond-reared salmonid or bass stream fishery.

The Deckers Hill Tributary appears to have brook trout potential. Assuming the gravel pit areas surrounding this tributary are used as sediment traps and for storm water retention following construction, this stream after construction, hopefully, will be worth the management required to remove silt, rebuild stream banks, and deepen holes which would increase natural trout productivity. No management of this tributary is recommended during construction, because some siltation will occur no matter how carefully sediment traps are constructed in the gravel pits or how carefully road crossings are built.

The standing crop (biomass or weight per acre) figures shown for a managed brook trout fishery in Lawrence Creek, Wisconsin[2] should be used as guidelines for the Deckers Hill Tributary. No numerical estimates for coho or rainbows runs to the proposed

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1 H. MacCrimmon, Personal Communication with Ecoplans Ltd.

2 Responses of a Brook Trout Population to Habitat Development in Lawrence Creek, Technical Bulletion #48, Dept. of Natural Resources, Wisconsin, 1971.

hatchery seem to be possible although experience being gained by MNR on rivers like the Credit should prove invaluable when time comes to make a decision on the proposed Clarkes Hollow Dam hatchery.

Since in the past cattle have been allowed to trample and graze on the floodplain of various creeks and rivers, now is the time to ensure that this situation is rectified. The agricultural leases should allow for the removal of all livestock on poorly drained soils within 100 feet on either side of running water, and on all imperfectly drained soils within the same zone where erosion is being generated.[1] Thus feces, urine, and sediment discharge will be minimized. Streambank fencing may be necessary in some cases, and gravelled and fenced walkways for livestock may need to be built for access to drinking water.

Similarly, the grazing of upland woodlots on well-drained soils and on all steep slopes (usually D and E classifications) should be discontinued wherever any erosion is evident. If the farmer is made aware of the potential grazing restrictions through his lease, he should not be resistant to these restrictions. The result will be sound soils, water and vegetation management practices. The benefit to fish and wildlife will be significant as well, because terrestial and aquatic ecosystems will have better structural integrity.

Minimum Standards for Water Quality and Quantity

The minimum standards for water quality and quantity may be described as maintaining existing conditions. As present evidence indicates that the Duffin watershed on the east portion of the North Pickering site contributes to a cold water sports fishery resource, these existing conditions are deemed to be high in quality. An extensive and intensive five year surface and groundwater monitoring program is presently establishing a more reliable base line of data for the Duffin watershed.[2] Urbanization must avoid disrupting the flow conditions of the streams that would tend to degrade or impair the fisheries potential of the watersheds.[3] In general, the development within the North Pickering site must adopt environmental standards that will not lead to unnecessary impairment to the overall fisheries potential of the watersheds.

Existing hydrological studies of the watershed areas have shown that the fisheries potential of the watershed can not adequately be determined without detailed studies, sub-catchment by

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1 While not specifically stated, the intent of this 100' allowance is understood to be part of the present Project farm lease, Schedule B, #9 and can be implemented by diagramming fence lines in the lease document.

2 Surface and Groundwater Monitoring Program, North Pickering Project, November 21, 1973.

3 It is expected that a fish management study being undertaken by the MTRCA and MNR and due for completion in December 1975, will set achievable fish management proposals for the Project area as well as other jurisdictions of the MTRCA; until the NP site is set in perspective by this overview, it must continue to adhere to the above stated standards and objectives as expressed to it by officials of the MNR.

subcatchment, to determine the impact of pollutant loading from urban storm runoff on the stream quality, given potential storm water treatment.[1] These studies, however, have indicated that the following environmental development standards must be adopted in order to maximize the fisheries potential:

1. The pollutant loading to the streams from urbanization must not exceed the pollutant loading characteristic of existing conditions if degradation of the fisheries potential would result.

2. All urban storm runoff within catchment areas having a fisheries potential must be handled through possible storage and treatment options. Storage of urban storm runoff will reduce the shock loading of pollutants by:
   (a) reducing the rate of runoff and
   (b) sedimentation and decay during the period of detention. Treatment will reduce the concentration of pollutants.

3. In each catchment area undergoing development, measures such as the construction of cisterns and ponds, rooftop gardening, roof ponding by constructed downspouts, porous pavement, backyard storage, vegetating channels, groundwater recharge, etc. should be evaluated for their effectiveness in a given area. This will require detailed hydrologic modelling of each catchment in terms of water quality and quantity.

4. Efforts should be made to reduce or eliminate unnecessary stream bank erosion by the use of vegetation or appropriate engineering measures.

5. All construction activity should be carried out in such a way as to reduce or eliminate unnecessary soil erosion that would result in siltation in high quality tributary areas.

Minimum Standards for Air Quality

The minimum standards for air quality shall be based upon standards defined by the Ontario Ministry of the Environment and the Clean Air Act, 1971. Ontario Regulation 15, (December 1974) of the Environment Protection Act, 1971, can be applied to prospective industrial operation on the site. Noise impact upon public open space and residential areas will be a specific concern integrated into detailed planning of transportation routes and industrial locations.

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1 Preliminary Analysis of Water Resources Impacts of Urbanization on the North Pickering Community, J.F. MacLaren Ltd., Toronto, March 1975, Appendix A.

Standards for Groundwater

Existing studies related to hydrogeology in the North Pickering site have not yielded adequately detailed information for the development of environmental standards related to the management of groundwater resources. Information provided from a proposed "detailed urban terrain constraints study" of the portion of the North Pickering site undergoing urbanization will provide the basis for developing environmental standards for groundwater management. This study is scheduled for completion in the winter of 1975-76.

Minimum Setback Requirements

Minimum setback requirements for structures built adjacent to the West Duffin Creek valley area have been developed. These setbacks have been determined for general planning purposes and are not based upon detailed geotechnical investigations of bank stability. Consultation with the Geotechnical Section of J.F. MacLaren Ltd., regarding the development of setback lines have provided adequate factors of safety for slope stability considerations. The criteria for determination of minimum setbacks of urban development are as follows:

1. In valley areas where there will be no flooding from reservoirs (the area above Clarkes Hollow) minimum setback is designated by a line three times the height of the valley measured horizontally from the toe of slope.

2. For any reservoir area, the setback is designated as a line measured horizontally from the toe equal to four times the height of the valley or depression.

3. In areas where the setback according to the above criteria is exceeded by the regional storm line (i.e. Hurricane Hazel - Design Storm) regional storm line was taken as the setback line.

4. In areas where the setback according to all the above criteria is exceeded by the MTRCA 'cut and fill lines', these lines are taken as the setback.

The resulting setback line indicates the area in which no structures should be built. This would include buildings and related parking lots. Areas within the setback line could be used for recreational or open space use. In addition the backyard areas of housing developments could occur within the setback line provided no engineering structures are built.[1]

Refinement of the minimum setback line should be determined on the basis of the detailed geotechnical investigations prior to site development.

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1 Adapted from Letter from Lloyd Torrens, J.F. MacLarens Ltd., to W. Wilson, NPP, March 20, 1975.

ENVIRONMENTAL ASSESSMENT OF THE PLAN FOR THE NEW COMMUNITY

In terms of reserving critical environmental areas the present plan for urban development has been thought through carefully. (See Map 2) An assessment of a Preliminary Phase IV Concept for urban development indicated that urban uses had largely avoided impact, at least spatially, upon significant environmental features of the site.[1] Part of the Phase IV assessment dicussing advantages and disadvantages in found in Appendix II. More specific impacts associated with the location of roads[2] and dams[3] both during and after construction were assessed separately. Climatological influences were also studied.[4] Complete copies are available in the Project's library. These assessments were preceded by activities of the environmental planning team in insuring that impacts could be minimized during the design process.

The formal documentation by the environmental assessment team contained this key passage:

> "It is essential to point out that this planning area is a complicated area topographically and biologically. To design a new town and still meet the environmental goals, especially those relating to surface water quality becomes very difficult. The desire to make the new town a self-contained "work/live" community is commendable; however, this concept is not necessarily compatible with water quality management. It would be, of course, ideal if everything that a new town needs could be comfortably fitted into the designated area. In the judgement of at least some of the environmental team, if this "work/live" concept is applied too strictly, a trade-off situation results.
>
> "If sufficient industrial and residential land is not available, other alternative areas off-site should be considered. But considerable public monies have been or are about to be committed for Great Lakes fishery management and for location of the Central York trunk sewer out of the Duffin Creek valley to maintain fishery potential. To jeopardize these multi-million dollar commitments by applying too strictly the "work/live" approach seems unrealistic."

There followed this assessment, an informal dialogue amongst the design team and further changes were made to the development proposals particularly in terms of industrial land allocation. It was recognized that more sensitive placement of industries in the eastern portion of the site could lessen impact to some degree. Such action was supported by water

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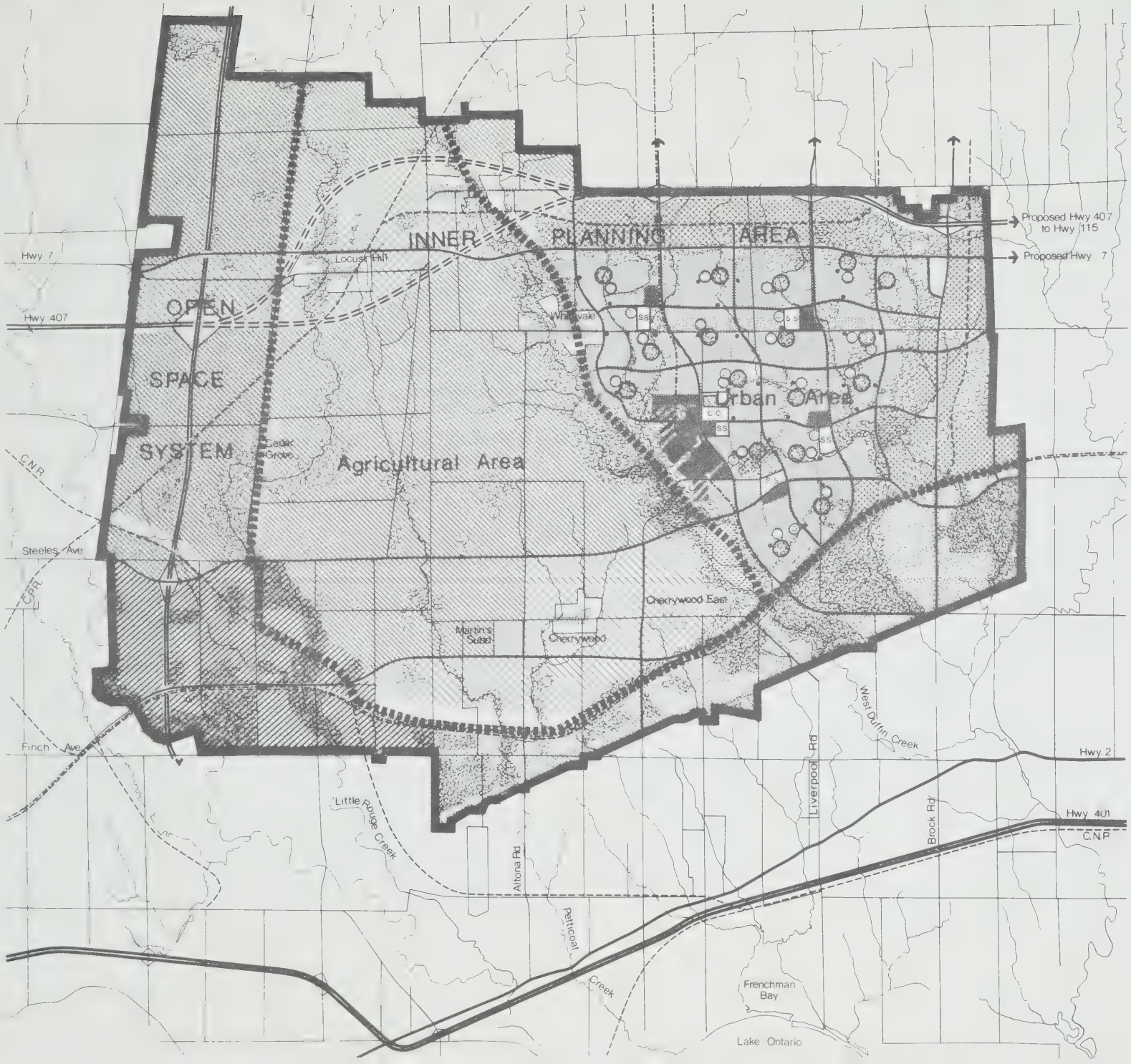
1 Environmental Assessment, Phase IV, Ecoplans Ltd., Waterloo, March 18, 1975.

2 An Assessment of Potential Environmental Impacts of Proposed Crossings of the West Duffin Creek, Ecoplans Ltd., March 14,1975.

3 Potential Dam and Lake on the West Duffin, Ecoplans Ltd. March, 1975 (also see Appendix III).

4 Report on Climatic Aspects of North Pickering Project, Ecoplans Ltd., (G.R. McBoyle), April 15, 1975.



North Pickering Project

Map No. 2

- Hamlets
- Housing
- Commercial, Soc. and Rec. Facilities
- Local Shopping and Community Facilities
- Industrial Areas
- Agricultural Area 1
- Agricultural Area 2
- CC Community College
- SS Secondary Schools
- Public / Separate Elem. Sch.
- Opportunity Sites
- Natural Areas
- Local Parks
- Open Space System
- Regional Park
- Possible Lake
- Storm Water Retention Areas
- Freeways
- Alternative Routes
- Arterials
- Railways
- Regional Transit Lines
- Transit Interchanges

Recommended Land Use Plan

100 HECTARES | 100 ACRES

1 Km.

1 Mi. 1: 50,000

plantown consultants limited

North Pickering Project Team
Ministry of Housing
Province of Ontario

quality studies done previously which modelled a concept without industrial lands in the east of the site.[1] (See Appendix IV for the development of this position.)

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1 Preliminary Analysis of Water Resource Impacts of Urbanization on the North Pickering Community, J.F. MacLaren Ltd., Toronto, March 1975, p.6, pp.14-15, p.35, p.17, pp.29-30.

ENVIRONMENTAL MANAGEMENT PROPOSALS

The process of inventory, goal setting, analysis and integrated assessment with other technical planning requirements leads to a series of management proposals. These are summarized below in so far as they have been proposed to date for natural areas and the known historical-cultural resources.[1]

Proposals for Management of Natural Environmental Resources

Valley Systems and Soils

Valley land conservation, preservation and management should follow some general principles of resource management summarized as:

1. control of slumping because of undercutting by river or freeze-thaw action on exposed wet scarps,
2. maintenance of vegetation on valley walls,
3. elimination of human foot and cattle traffic on slopes over 15 per cent,
4. replanting of exposed slopes with grass, sumac and aspen (the latter two providing a root mat by cloning) or cedar (limbs layering, taking root when in contact with the soil),
5. Storm flow regulation to reduce streambank erosion due to high waters at high velocity and flow regulation to prevent alkaline river water from flooding hemlock stands, which require acidic soils, and
6. contour plowing and maintenance of grasses waterways.

The large areas of bank slumping along the West Duffin Creek valley are probably the combined result of three historic factors:

1. cutdown of the riverbed, which has been accelerating since Caucasian settlement because of sediment load in runoff,
2. cultivation of tablelands which has created more overland flow to cut into lip of valley, and
3. removal of forest cover and conversion to agricultural land uses on the table lands.

Since none of these landscape alterations can be returned to the 1800 baseline, slumping will continue to be a problem well into the future. However, overland flow can be controlled at the valley rim by collecting it and channelling it down the bank in gabion reinforced ravines. Gabions can protect the valley where the channel is undercutting the bank. Because bank swallows which nest in these unstable banks are also a valuable resource, their nesting areas should not be disturbed.

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1 Agricultural Management is basically being expressed by a farm lease programme at this time. Rehabilitation of farm units is being considered and a programme is being formulated for review by the North Pickering Corporation Board.

The natural sequence of recolonization of these banks seems to depend on the aspect (direction of slope to the sun) and soil moisture. Very wet "soupy" areas should be planted to willow, alder, white cedar, and balsam poplar. Dry south-facing slopes can be revegetated with trembling or large-tooth aspen, sumac, grapes and virginia creeper. The grape and creeper, planted on the rim can be "thrown down" the slope to root where the stem touches soil. Planting will only be successful where an angle of repose, or stable slope, seems to have been reached (preferably no greater than a 1 to 1, although some soils may stabilize at a 2 to 1 ratio.)

Wet horizontal sand lenses, under the effects of freeze-thaw action will undermine the bank; planting aspen and cedar seedlings horizontally into the lenses may dry them up in summer, and shade them in winter, thereby reducing slumping and freeze-thaw action.

Because the Clarkes Hollow Dam would flood the major areas of bank slumping on the NPP site, additional setbacks on the tablelands determined by engineering geology analyses are mandatory (in addition to those covered under 'management standards'). The height of water in the reservoir will also affect the required setback, since height affects the amount of slumping. The near vertical nature of many banks could cause massive slumping in some sections depending on reservoir height.[1] Until the building of the dam is resolved along with its height, and the location of road crossings, no engineering of the banks is justified.

Rate of cut-down in the valley can be approximated from old maps and 1945 aerial photos; the dynamics of the bank systems from detailed surficial geology mapping and examination of erosion from tableland sources. Before a reservoir height is determined, such analysis should be done.

Contour plowing and maintenance of grassed waterways can be supervised by the lessor. If critical areas require further maintenance, specific stipulations can be included in the lease.

Water Resources and Fisheries

Water resources management entails management of quantity and quality and control of upland soil erosion. Fisheries production depends on stream bed configuration (linear length, depth of pools, etc.) as well as quantity and quality of flow. Improvement in fish production potential over the present baseline is possible if storm water retention areas, now part of the planning concept, can provide flexibility in managing peak flows and in renovating storm water and thereby reduce pollution of trout-quality waters. In addition, these ponds will act as

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1 It is presently anticipated that a level of 474 feet would be reached under flooding conditions and would remain at this height for only a few hours. The recreation level of the reservoir would be much lower.

sediment traps. Effective design of an urban storm water drainage system will require detailed (field calibrated) hydrological modelling of each sub-catchment for water quality and quantity in order to simulate hydrographs, pollutant loading, and the resulting effects on the quality and quantity of stream flows along various reaches of the watersheds. Costs of hydrological modelling required for effective storm drain design will involve $10,000-30,000 per sub-catchment plus a maintenance of the water monitoring program to compare during and after effects of construction.

The issue of fisheries is somewhat complicated by the absence of trout for a sports fishery in the portions of west branch of Duffin Creek in the new community site, in spite of the stated environmental goal of reintroducing a cold water fishery here. If a dam is built near Clarkes Hollow, the movement of lake-run trout will be inhibited, although a fish ladder could be built. However, even if lake-run salmon and rainbow trout were to move upstream to Whitevale Pond and pass a ladder there, the limited number of natural spawning areas at or above Highway 7 suggest that little benefit would come from encouraging salmon and rainbow to go this far. Present warm water temperatures further reduce a sports fishery potential in this segment of the stream.

Another possibility would be to build a hatchery below the proposed Clarkes Hollow Dam and strip returning spawning fish here for milt and eggs. Then the Clarkes Hollow Dam or reservoir could have a warm water (bass) and possibly a stocked rainbow fishery, if the water were cool enough, deep enough, and well enough oxygenated. Similarly, Whitevale Pond could have a smaller population of warm water fish: a bass, perch, rock bass mixture, or only bass. This combination of reservoirs would provide summer bass and rainbow fishing, fall salmon fishing, spring rainbow fishing in the Clarkes Hollow Dam, and possibly a limited ice fishing season.

As present fisheries in the West Duffin Creek branch are absent in the new community site, these proposals would considerably augment the fisheries, albeit introducing a certain level of artificiality to the situation.

Wildlife Habitats

Management suggestions for terrestrial and avian wildlife are included under the standards section entitled "Minimum habitat requirements for Wildlife and Fisheries". They are arrived at according to projections of probable species survival under urbanized conditions.

Wooded Resources

The approach proposed here can be called "urban forestry": combined concepts from plant ecology, commercial forestry, wildlife management, soil science, and landscape architecture within the context of an urbanizing landscape. The North Pickering site is an ideal area to test these new man-in-

nature concepts. Successful innovations may stem the long historical degradation of wooded areas in Southern Ontario due to high grading (selective removal of best trees) fire, and grazing. In turn, a stemming of degradation may encourage the professional practice of forestry in Southern Ontario as opposed to the heavy emphasis on timber, paper, and pulp industry in Northern Ontario.

The management suggestions are taken principally from a memorandum entitled "Guidelines to Management of Woodlots in the North Pickering Project".[1]

After construction many woodlots outside the central area will be influenced by a warmer urban environment as previously discussed under potential vegetation changes. From the Site Region Analysis Charts of Hills,[2] the urban area will become part of Site Region 7E, an area of a wider potential for hardwood plantings typical of a more southerly zone. A wider range of hardwood species achieves two objectives: increased diversity and enhanced aesthetics, and possible long-term value accretion for specialty hardwoods like black walnut. The urban forestry approach will provide detailed treatement prescriptions for each area based on two major variables: area use categories and cover-type/age classes as described below.

Further, this approach tailors each area on an ecological basis appropriately for its particular use, be it amenity, recreation or education.[3] Finally it does so at minimum cost, by taking advantage of maximum use of natural landscaping (forest eco-systems) and efficient salvage of trees requiring cutting or moving; and hence clearing costs and maintenance costs are reduced or eliminated.

Urban Forestry Treatment Prescriptions

1. Wooded Area Use Categories

The following end-use categories can be assigned to mapped forest unit areas after the Phase IV design is ready.

Use Category	Limits of Treatment
a. Preserve (for nature education)	remove only dangerous, decayed or infected trees; leave den trees, blue beech, hop hornbeam, shadbush, and large male aspen trees for budding grouse in winter

1 Memorandum by K.W. Horton, January 31, 1975, and modified by Ecoplans Ltd.

2 The Ecological Basis for Land Use Planning, G.A. Hills, Red. Report 46, Ontario Department of Lands and Forests, 1961.

3 "Woodlot Tolerance to Impact of Human Use and Drainage Changes" by Horton Forestry Services Ltd., March 2, 1974.

b. Natural area (light use conservation area	lightly thin for access, underplanting and edge-planting; leave den trees
c. park (moderate use)	clean, moderately thin select cut, underplant and patch-plant to add variety; leave den trees, blue beech, hop hornbeam, shadbush
d. park (heavy use)	clean, heavily thin and selectly cut; horticultural plantings, remove den trees where they cause personal injury.
e. development site	preserve resistant specimen trees or tree clumps where possible
f. utility corridor	reduce width of clear-cut strip to minimum for construction and operation replant suitable trees and berry bearing shrubs if possible, especially dogwoods, viburnums, grape treat remaining R.OW. same as adjoining woods preserve den trees manage ecotone (field/bush woods) for wildlife

Generally, these categories will be located in the following combinations on various open-space systems:

Wooded valleys slopes 0-5%	a to d
Wooded valleys slope 5-15%	a to c
Wooded valleys slope 15-45%	a only
Peripheral open space	a to d, and f
Upland woodlots	c to e
Cross linkages	b to d
Utility Corridor	f only

2. Woodlot Types and Management Suggestions

Woodlots have been mapped in broad cover-type/age classes reflecting the ecological effects of site conditions, historical origin, and successional patterns. These main types, pertinent sub-types, and treatment implications are outlined below:

Intolerant Hardwoods (IH) Type

Subtype - poplar, white birch, pin cherry
Management - favour birch; underplant white pine, oak; plant walnut
Subtype - hawthorn, white ash
Management - favour ash, plant pine, oak or scarify and seed; plant walnut on suitable microsites where pine will not be killed.

Mixedwoods (M) Type

Subtype - intolerant hardwoods, white pine, cedar
Management - favour pine, maple; patch - plant pine and oak or scarify and seed in patches.
Subtype - tolerant hardwoods - hemlock, white pine
Management - favour hemlock, yellow birch, maple, ash, pine; patch - plant and edge-plant oak, pine, hickory.

Softwood (S) Type

Subtype - hemlock grove (with pine, yellow birch, maples)
Management - preserve, patch-plant pine, oak
Subtype - cedar, hemlock, pine
Management - favour pine, hemlock
Subtype - plantation red pine or scotch pine
Management - thin periodically; encourage intolerant or tolerant hardwoods to diversify stand.

Tolerant Hardwood (TH) Type

Subtype - immature maple-ash-basswood-birch
Management - favour best stems, clean out inferior species but preserve hop hornbeam, blue beech, shadbush in understory
Subtype - mature sugar maple-beech with hemlock
Management - favour maple, basswood, patch and edge-plant oak, pine, hickory; retain best clones of beech.

Cedar (C) Type

Subtype - cedar slope
Management - preserve, patch-plant pine, ash, oak, as openings develop. Leave aspen, sumac where root mat protects slope from slumping.
Subtype - immature cedar flat (post-size)
Management - thin, selection-cut.
Subtype - mature cedar flat (pole-size)
Management - preserve or clearcut and plant cedar, ash, silver maple, swamp white oak (if available).

Mixedwood Swamp (M) Type

Subtype - cedar-black ash-soft maple-hemlock-elm-poplar-birch
Management - favour maple, yellow birch, hemlock.

Hardwood Swamp (h) Type

Subtype - soft maple-black ash-elm (dying)
Management - patch-plant knolls with white pine, white ash, walnut
Plant wet areas with swamp white oak some sycamore to diversify stand.

3. Procedural Suggestions

a. assign use categories to woodlots when design for development becomes available;
b. combine management recommendations for use category and cover type or subtype to obtain a prescription for each woodlot;
c. plan a work schedule giving priority to areas slated for initial servicing and development; ADEQUATE LEAD TIME IS A PRIME CONSIDERATION.
d. mark trees to be removed, calculate timber volumes and stumpage values according to products (see below). Be careful to leave den trees in all but heavy park use areas, individual lots;
e. use MNR regional forestry marketing system in which notices of timber sales are distributed to all prospective buyers, bids are solicited and cutting contracts negotiated. Contracts may include cutting of non-merchantable timber and cleanup requirements (piling brush);
f. if necessary, make separate arrangements to sell sub-merchantable trees for fireplace wood, posts, rails, etc.;
g. supervise cutting operations, utilizing a penalty system for the cutting of unmarked trees (e.g. require a performance bond);
h. collect stumpage revenues;
i. arrange for brush disposal, salvage of transplantable trees and prescribed planting treatments using student work programmes as much as possible;
j. the above can be handled under existing operational arrangements, i.e. forestry supervisor and technician (under contract) with the cooperation of the Regional forester's office, MNR.

4. Forest Crop Possibilities

Since the bulk of the forested area is in designated open space, particularly the valley lands, conservation and amenity values far exceeds the commercial value. In view of the demands for development, recreation and agriculture, it is not feasible to designate areas primarily for timber crop production. Nonetheless, there are tree crop possibilities, particularly in the following aspects:

a. Salvage - Timber salvaged from the clearing of development areas, service rights-of-way, lakebeds and pondings can bring significant returns if marketing is organized. Also there will be timber from the periodic thinnings and cutting in parklands. The products and their general present stumpage values would be:

Veneer logs (scarce) large maple, oak	$200 per M bd.ft.
Sawlogs (hardwood & softwood) min.diam.12"	$ 50-100 "
Hardwood bolts - diam. 8-11:	$ 5 per cord (128 cu.ft.)
Hardwood pulpwood (questionable market)	$2 - 3 per cord
Fireplace wood (good local market)	$2 - 5 per cord
Cedar posts, rails, poles "	50¢-$2.00 per piece

b. Veneer Log Production - This is one timber product that could feasibly be developed over the long-term on a limited scale and would involve high-quality species, such as walnut, oak and black cherry grown in small groups or groves on good sites in open space systems. Limited amounts of yellow birch are also available and should be encouraged. Such an area also serves an amenity function.

c. Transplantable Landscaping Stock-Respecting wild stock, this has limited applicability: most forest-grown trees are unsuitable as to species, form, and root growth. As an exception there are a few small areas of "natural nursery", usually adjoining woodlots, where cedar or white ash saplings could be thinned and transplanted. More feasible is the planting of blocks of inexpensive seedlings of desired species on reserve land for any necessary transplanting.

d. Tree Nurseries - In addition to the Project's Plum hollow or Chester Tree Farm, which is producing shade trees for arterial road landscaping, there are several small (2 to 5 acre) nurseries operating privately. This appropriate land-use in the urban agricultural area could be encouraged on a lease basis with a view to the large market for lot landscaping stock that will develop with the town site.

e. Christmas Tree Farming - This possibility is not advocated since the required large, sandy areas, all in the eastern sector of the townsite (gravel pit areas), will not be available.

f. Sugarbushes - There are several maple stands suitable for small scale sugar bushes, but are not expansive enough to constitute viable operations. Some could be set up as an additional cash crop on farm units or as a demonstration sugarbush - very popular for family recreation and outdoor education. Two suitable areas are Glens Glen (south of Brougham) and Woodland Park (Cedar Grove).

5. Hedgerows

Hedgerows should either be used on one side of a road alignment, preferably upwind (north or west) away from winter salt spray or, designed into backyard lot lines. Placing them in front yards should be avoided since servicing brought in from the street kills treed zones on anything smaller than lots 75 feet wide or wider. Unusually close site supervision must be maintained. Existing hedgerows have been classified according to their potential use in an urban setting(as in "Hedgerow Value in Terms of Urban Use Potential" by Horton Forestry Services Ltd., March 1974) around houses, and around orchards. Two-year old stock minimizes planting costs. In five to ten years, about mid-way into the new town building, these trees should be well established.

Preliminary planting areas have been mapped.[1] Plantings were begun this year in river valleys. The type of planting, objective and quantities are indicated in the table below.

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1 Map entitled: "Open Space Reforestation Program, Proposed Tree Planting Sites, dated November, 1974", by K. Horton.

SUMMARY OF TREE PLANTING PROPOSALS - NORTH PICKERING PROJECT

Type of Planting	Objective*	Planting Date	Out-Planting Date	Stock Source	Stock Cost/ Tree	Species**	No.of Trees (approx)	Initial Size Class	Trans-Planting Technique	Reference
Institutional	Landscaping -large decorative shade trees	pre '73	'76 on	Chester Nursery NPP	$7-$100 av. $34	exotics	2,800	1.5-8" diam.	Stringball (heavy equip.)	Inventory, Sheridan appraisal Feb.23,'7
Arterials	Landscaping 7M/ yr over 15 yrs. (300trees/mi)	pre'73	'76	"	$7-$8	nM,rM	500	8-12'	bare-root (light equip.)	"
		'74	'76 on '78	Private to Chester	$2.50 av.	hM,nM,wB, Lin.	7,000 6,000	4-10' 2'	"	Horton Int.Rep. #12
		'75	'78 on	MNR Nurs. to Chester	1¢	sM,rM,rO, wA,bWa	8,000	seedl.	"	Memo Horton-Wilson. Janl0'75
		'76 on	'79 on	" &priv.			7,000/yr	"		in future
Parks and Parkways	Landscaping 86m trees,40m shrubs over 10 yrs. (100 trees/a. in clumps)	'74 on at MNR St.Williams Nursery	'76 on '77 on	M.N.R. "O.L.A." stock	83¢ ave.	wP,rC,wS, nS,wC,rM, sM,O,wA, sA,mt.A, wB,Wi,yLo, Hi,Lin+8 spp.shrubs	12,600/yr	from seed del'd 3-6'	"	MNR Memo Staley-Horton Nov21'74
Conservation (Cw)***	Open space water course & wildlife cover. Group plantings.	'75 on	'75 on direct	MNR nursery	1¢	Dry-rO,bLo,wP Fresh-bWa, cPo,wS,Moist-wA,sM,wC,Wi	40,000	seedl.	Hand & machine	MemoJan. 10'75 Horton-Wilson & map "Proposed plant sites"Nov
Conservation (Ce)***	Erosion control steep slopes & slippages	'74 '75	'74-'75	"	1¢	cPo,bLo,Wi,Wc "	4,000 10,000	" "	Hand "	above & Horton Interim reports 5 & 18

Reforestation (L) ***	Landscape cover in open blocks Under +edge planting in wooded areas	'76 on	'76 on (direct)	"	1¢	Drier-cPo.wB, bLo,rO,bO,wP, rP, Moister-sM, wA,bWa,wC,wS,eL	50 m-100m/yr to capac.	"	Machine and hand	Map Nov'74
Reforestation (S) ***	screening, shelterbelts & linkage strips	'76 on	'76 on	"	1¢	combinations of -cPo.sM,wS -bLo,wP,O -bWa,wC,S	50M-75m/yr to capac.	"	Machine	"

* for general objectives refer to NPP Forest Resources Development Policy

** Species symbole - M-Maple, nM-Norway, rM-red, hM-hard(sugar), sM-silver, wB-white birch, Ba-basswood, Lin-linden, wA-white ash, gA-green ash, mt.A-mountian ash, bWa-black walnut, Wi-willow, cPo-Caroline poplar, bLo-black locust, yLo-yellow locust, rO-red oak, bO-bur oak, wP-white pine, rP-red pine, Hi-hickory, wS-white spruce, nS-Norway spruce, wC-white cedar, rC-red cedar, eL-European larch

***See Open Space Reforestation Program map, dated November 1974, for explanation of these symbols

Outdoor Recreation and Education

The open space design envisages a continuous system of corridors linking all types of open space lands with connections to other community use centres. This would permit pedestrian and bicycle movement between all community resources and to key resource areas outside the community.

The north-south valley lands would form an integral part of the system, providing linkage to the lakefront and to the several conservation areas and parks in the Duffin and Rouge valleys. These would be linked by east-west corridors on the tablelands, taking advantage of woodlots and drainage courses wherever possible. Such tableland corridors would expand where appropriate to accommodate high-use recreation such as neighbourhood parks, playgrounds, school playing fields, etc. The tableland system would connect by fine-grained walkway corridors to each neighbourhood, including passive-use park areas.

Water courses and wooded strips are preferred as focal areas for the neighbourhood rather than buffers between neighbourhoods. This implies some development of drainage courses for passive use such as walking and cycling. Existing natural features would be retained as much as possible and enhanced by plantings.

A main hiking trail has been developed along the West Duffin, with parking facilities at the terminal points, interpretive loops in interesting natural areas and a nature preserve in the vicinity of Whitevale Pond.[1] This action has been prompted by an awareness of a need in schools of the region for outdoor educational resources. Such a development also makes interim use of lands which would otherwise remain unused for a long period of time or would be perhaps used for other than recreational uses if such an activity was not already in evidence. Unstable steep valley slopes are being avoided. Outdoor education is being encouraged as the major use. Sport fishing would be emphasized for the East Duffin Creek which is suitable for trout.

In the lower Little Rouge Valley, the presence of the Metro Zoo, conservation lands and woodland park, in close proximity to proposed inter-urban transportation facilities, suggests development of a major recreational complex. It would include campgrounds, multi-use playing fields, golf, skiing and riding facilities, comprehensive outdoor education centre and possibly other active recreational setups, some sub-regional in scope. Much of this could be developed and managed as a unit, realizing economic advantage.

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1 Proposed Hiking Trail, West Duffin Valley, North Pickering Project, K.W. Horton, and W.M.C. Wilson, November 21, 1974.

Proposals for Management of Human-Made Environmental Resources

Rationale

The archaeological and architectural historical resources within the North Pickering site lands afford an unique opportunity to integrate the prehistory and history of the site into the future development. The rich cultural and social heritage can serve as a link with the past in order that future residents may better understand the "new" environment that is being created. However, if this sense of historical continuity is to occur, management policies for these resources (which recognize their potential value to the new community) must be developed.

Archaeological Sites

Before any development occurs on the North Pickering site, expertise in archaeology should be consulted to ensure that no sites are needlessly destroyed. The results of Konrad's archaeological survey of these lands should form the basis of a management plan for archaeological sites.[1] Of the 59 sites identified in the archaeological survey, Konrad selected 28 for special consideration and placed them into three categories:

1. sites that must be preserved for salvage,
2. sites that are suitable for prehistoric reconstruction and interpretation,
3. sites that require further investigation.

Sites in group 1 should be zoned from any development until salvage work has been completed. Funds should be made available immediately from (or shared by) the new Ministry of Culture and Recreation to establish the status of sites in group 3. Selection of one or more of the sites identified by Konrad in groups 2 and 3, and possibly 1, for eventual reconstruction should proceed without delay. A trained archaeologist from the Ministry of Culture and Recreation's regional office could become associated part-time with the new town's proposed environmental management team and could be jointly funded by the Ministries of Housing and Culture and Recreation. He or she should direct the salvage and reconstruction work. Lead time to salvage a threatened site is essential, making early notification of a development proposal critical. A regional archaeologist could act as a "watchdog" on construction to prevent any sites previously not identified from being destroyed.

Working with the local educational system, the regional archaeologist could recruit salvage teams from interested upper level and secondary school students who would be given an opportunity to participate in original research. Local people

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1 V.A. Konrad, et al. North Pickering Archaeology, Research Report 4, North Pickering Project, June, 1974. Also see map entitled, "Recommendations for the Preservation, Salvage and Utilization of Archaeological Sites" based on above report and produced by North Pickering Project at scale of 1:10,000 dated March 18, 1975.

could be employed in the reconstruction of former village sites. Artifacts recovered from salvage operations would be given to a local museum.

Fortunately, only three identified sites are located within the inner planning area. These sites should be given priority in salvage operations. The majority of the identified sites are in the outer planning area, particularly in the southwest corner of the NPP lands. Since this corner has been recommended as the location of a regional park and since several of the sites in this location are suitable for reconstruction, archaeological interpretation should be an essential part of any park development in this location. The remaining scattered sites in the outer planning area are in agricultural lands. Some provision for protection of the identified sites and access for qualified archaeological personnel to conduct salvage operations should be made in the proposed farm leases for these lands.

Architecturally and Historically Significant Buildings

The survey results of architectural and historical buildings[1] should be the basis of a management plan for these resources. The survey has identified four basic classes of structures on the NPP lands:

1. structures of such architectural merit and cultural importance as to be of provincial significance, at the very least, and warrant preservation at any cost, preferably on current sites,
2. structures of substantial architectural merit and cultural importance that should be preserved,
3. structures of architectural merit that have considerable regional, cultural or historic interest and that could be preserved for residential or commercial occupancy on current sites or elsewhere, and
4. structures that because of unique structural or design features warrant further research.

Thus, the first priority in a management plan for architectural and historical buildings is to recognize the unique importance of buildings in classes 1 and 2. The intrinsic value of these buildings makes them key design elements in the new urban framework. Properly utilized in situ, their presence can lend definition and variety to the proposed new community. Possible uses are residential, commercial, and institutional depending upon location. However, suitable controls as to lease or sale of these structures should be formulated to ensure that the qualities which make them unique are not altered or destroyed by future occupants. When the detailed design is developed, an architect and/or landscape architect should be consulted to guarantee that these structures are properly integrated through design and landscaping into the surrounding area.

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1 Architectural Evaluation Panel. Architectural Evaluation of the North Pickering Project and Toronto Area Airports Project Sites, 2nd edition, June, 1974.

In the urban orientated planning zone, special consideration should be given to the village of Whitevale and to the structures along concession road 5 east of the village. This combined area represents a remarkable example of rural and village life of nineteenth century Ontario. Structures in classes 3 and 4 could be removed from other locations within NP lands and possibly the airport site to this area, for there is considerable opportunity for in-fill in both the village and along concession road 5. Such development would reinforce the village character of Whitevale, which could be encouraged to develop as a viable 19th centry Ontario farm village complete with working mill. Whitevale would then serve as a unique and enlightening contrast to the proposed new community central place to the south. A museum might be located here.

Structures in classes 3 and 4 which are not suitable for removal because of their construction and which must be demolished should be carefully described before demolition for details of construction, general design, and unusual detailing. After demolition, rather than being destroyed, materials, such as doors, mantlepieces, and flooring, should be made available for any restoration work on NP lands.

In the agriculturally orientated planning area, special consideration should be given to the group of Mennonite buildings at the corner of Steeles Avenue and the Markham-Pickering township road. This complex warrants special concern and protection particularly because of the proposed widening of Steeles Avenue. To coordinate the overall utilization of the architecturally historic buildings in the new community design and to supervise the actual relocation of certain structures, an architect having experience in restoration should be part of the new community design team. This architect could be partially funded through the Ministry of Culture and Recreation particularly as the NP concept affords the opportunity to develop a prototype approach to the integration of historic architecture in new development.

DETAILED PLANNING AND DESIGN

The following guidelines relate to detailed planning and design as distinct from physical management activity. They are intended for the secondary and subdivision plan scale of planning activities.

Wooded and Natural Areas

If woodlots must have housing, servicing, or roads constructed in or through them, some general rules should be followed:[1]

1) Roads and housing should enter woodlots from cooler east or north side;
2) Roads and services should be placed through aspen or sumac edges since these species will reform by root-sprouting a new edge quickly and naturally;
3) Selectively precutting an area 3 to 5 years prior to its urbanization allows remaining viable trees to "harden" from the increased sunlight;
4) Tree stands on imperfectly or poorly-drained soils will suffer badly from dropping the watertable. If such watertable manipulation occurs having ash and hard maple trees (preferably upwind) nearby will provide for natural reseeding. If natural reseeding does not occur, replanting and removal of blowdown may be required;
5) Cedar on poorly-drained organic soils can survive a drop in watertable, if the soil is protected from sunlight. Southern and western edges must be "tight": lower boughs should not be pruned, or replanting should be done with cedar or aspen to close the edge quickly;
6) Beech along an exposed southern or western edge of a wooded area may die of sunscald. If allowed to die in situ, root sprouting often occurs 10 to 20 feet into the forest maintaining stand diversity; when the main tree stem dies, it can then be removed;
7) Valuable treed areas in construction zones require snow fencing around them. Generally treed zones between the street and house are difficult to save because of service lines, piling of building material, parking of workingmen's cars, etc. Though treed areas in backyards can be more easily saved; they should be fenced;
8) Posting a performance bond can be helpful for preserving especially valuable treed areas in housing and construction zones. A value of $10 per square inch, approximating its replacement value, is a conservative value for a sound tree.

For wooded areas where housing will intrude, a detailed tree survey (discussed under appendix II), numbered and

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1 Urban Forestry Treatment Prescriptions for wooded resources per se are detailed in pages 22-28 in terms of use categories, woodlot type and procedural suggestions.

mapped on a 1" to 40' base map, can help designers minimize the direct loss of high value trees by identifying trees having high survivability. Wherever possible, orchards should be retained in courtyards, backyards, or park systems within the community area.

Storm Drainage

The concept of using existing gravel pits or specially created excavations for containing storm drainage seems to be the only method of ensuring that high quality water reaches the Duffin Creek tributaries. Furthermore, during construction the pits can act as sediment basins.

Existing hydrological studies have shown that the pollutant loading of urban storm runoff would have an adverse effect on stream water quality unless effective measures of storage and storm water treatment are incorporated into the management of the watershed.[1] The effective use of modelling techniques could suggest a variety of storage and treatment options intended to maintain an acceptable water quality in the streams and maximize the fisheries potential.

Scale of Analysis and Timing of Construction

Present soils information, especially the depth to watertable are too sketchy for construction guidelines to be proposed for the protection of each woodlot. When detailed mapping is available, it will be possible to relate watertable to tree composition. With this information if the watertable adjacent to a poorly or imperfectly-drained forest zone is to be lowered temporarily, the work can be done safely during the dormant period of tree growth. Construction as well should be outside the "drip line"[2] of the treed area.

Where stream crossings are to be built, construction should avoid where possible the fall salmon run from September to November and rainbow spawning runs between March and July, thereby minimizing disruption of migration because of sediment discharge.

Climatology

Wind tunnel and snow "tunnel" testing are suggested for the central area to project the likelihood of unpleasant wind effects and the possibility of undesirable snow accumulations near service areas, building entrances, courtyards, freeway intersections, etc.[3]

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1 See appendix IV for development of this position.
2 The "drip line" is the distance away from the trunk equal to the horizontal spread of the outer branches.
3 Report on Climatic Aspects of North Pickering Project, Ecoplans Ltd., (G.R. McBoyle), April 15, 1975.

Legislation and Regulation: Development Control Guidelines

As an example, under Bill 264, an Act to amend the Planning Act, Section 35(a) was added in December, 1973 which could enable a municipality to have legal authority to implement several of the above guidelines (a) through (f) in the North Pickering site.[1] Two such development control matters which have influence in Section 35 (a) are as follows:

> "Grading or change in elevation or contour of the land and the disposal of storm, surface and waste water from the land and from any buildings or structures thereon.
>
> "Wall, fences, hedges, trees, shurbs or other suitable groundcover to provide adequate landscaping of the land or protection to adjoining lands."[2]

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1 NPP is subject to several other acts both Federal and Provincial such as Conservation Authorities Act, Sec. 20, Ont. Reg. 253/64 applicable to fill and construction.

2 Guidelines for Development Control, (Site Plan Control), The Planning Act: Section 35(a).

CONSTRUCTION PRACTICE GUIDELINES

The fact that enormous sediment loads are generated during urban construction is well established in many North American studies. Since Duffin Creek and the marsh (at Lake Ontario) are valuable fisheries and wildlife habitats, an erosion management plan, carefully conceived, must be initiated. This includes careful consideration of the following elements:

1) phasing of construction to dry periods in especially sensitive zones,
2) sediment traps particularly for dewatering trenches,
3) temporary sediment traps for normal runoff,
4) temporary seeding of steep slopes over 5 per cent, and
5) restabilization of slopes.

To achieve such a management plan, a soil scientist will have to work directly on the subdivision servicing and design, contract specifications going to tender, on field supervision of construction, and on post-construction renovation. He can, as well, assist in special management problems arising in the agricultural zone, and agricultural buffer zone.

Based on these considerations a manual has been developed with the assistance of the Ministry of the Environment intended for use by builder-developers. The manual is in two parts. The first section (see Appendix V) relates the construction practices to the development-plan approval process. The second section (see Appendix VI) describes the desired construction practices and procedures. It is expected that this manual will be modified by the development team of the Corporation as review occurs.

The principal value of this manual, is expected to be derived by Project personnel in that it will provide a guide to their monitoring duties on site--a check list perhaps. It is hoped, however, that builders will appreciate the benefits of following these guidelines by reading them and discussing them with Project personnel.

PROPOSAL FOR ON-GOING MONITORING AND SUSTENANCE OF HISTORICAL RECORD OF CHANGE

The natural resources requiring an on-going monitoring are water quantity, water quality, wildlife, and vegetation. The monitoring of the first two, except for storm water ponds, will be done by MOE or MTRCA and Environment Canada. The latter two and storm water ponds can be ascertained by the following procedures:

1. Storm Water Ponds - Water quality entering and leaving must be monitored to achieve empirical operational guidelines on water temperature, sediment control, BOD reduction, dilution effects, etc. This will be done by the proposed water chemist on the staff of the new community.
2. Wildlife - Breeding bird transects, utilizing a ½ mile grid (from the Audubon Guidelines) covering the entire site, should be run 3 to 4 times in reverse directions. Selected woodlots, ponds, and special breeding areas, such as banks for swallows, can be quantitatively surveyed for breeding pairs. When it is run every third to fourth year, trends in diversity and abundance of breeding birds can be monitored. Annual Christmas bird counts should be conducted. Around these censuses, specialized management programmes can be designed. Secondary students and nature club members should be encouraged to participate in these censuses and in analysis of the trends.
3. Fisheries - Stream shocking is suggested every 2 to 4 years to assess the effectiveness of storm water management. The frequency and planning of this work requires more detail.
4. Vegetation - From the baseline data in the Walden Report,[1] quantitative re-evaluation of all woodlots should be done every 10 years to establish any successional trends.

Depending on the technical staff available, this work can be supervised by either NP environmental personnel, or done by volunteers, or consultants. If a NP environmental management section is established, the environmental co-ordinator would be a logical individual to supervise the monitoring responsibility.

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1 F.A. Walden and M. Griffiths, A Biological Survey of the North Pickering Project Site and Toronto II Airport Site.., Ontario Ministry of Housing, 1974.

COST IMPLICATIONS FOR ENVIRONMENTAL MANAGEMENT

Following from the above discussion of desirable and necessary activities for environmental management a significant task force of specialists is visualized. The character of such a task force is multi-disciplinary but particular expert knowledge would not be required in many cases on a full time basis. For this reason, a strong managerial approach, with adequate flexibility to cross disciplinary and departmental lines is essential. A table of estimated costs for personnel and equipment during new community construction follows below:

Cost Estimate Summary for New Town Environmental Management Measures

Personnel for New Town Staff (During Construction)	
Supervison and Coordination	
Environmental Coordinator	$18,000 - $20,000/yr
Field Labour, Nurseryman, Arborist, general workmen (3)	21,000 - $25,000/yr
Secretary	7,000 - 8,000/yr
Water Management and Control	
Water Chemist (shared 50:50 with MOE)	7,000 - 8,000/yr
Hydrologist for Modelling Storm Water by subcatchment, secondary planning stage (consultants)	15,000 - 30,000/sub-catchment, approx. one subcatchment/yr
Soils Management	
Soil Scientist (shared with MAF), 1/3 full-time (consultant)	7,000 - 10,000/yr
Forestry	
Forester 1/3 Full-time (supervise planting orchard management, nursery management)	8,000 - 10,000/yr
Fish and Wildlife	
Fishery and Wildlife Biologist/Ecologist (Consultant or cross-budgeted with MNR)	4,000 - 6,000/yr
Recreation (Extensive and Intensive)	
Recreationist/Outdoor Education (1/4 to 1/2 time to lay out trails, prepare interpretive booklets, full-time at population of 40,000 people)	3,000 - 5,000 (first 7 years)

Cultural Affairs	
Archeologist (shared 50:50 with MCR)	7,000 - 9,000
Architect/Planner (covered by current staff in Corporation)	none
Restoration Architect (half-time)	7,000-10,000
Surveillance	
Police Supervison open-space areas (budgeted by Corporation separately)	none
Travel and Sustenance	
All Personnel	9,000/yr
Equipment and Supplies	
Water Chemicals, water lab equipment, trucks (1) etc.	7,000/yr
Tree Planting and Nursery Operation	
50 acres/yr. at $100/acre	5,000/yr
Nursery stock	3,000/yr.
Nursery Building Mainteance, Ground Management	
Supplies, equipment, temporary help	15,000/yr
Stream Rehabilitation	
Silt removal, stream bank construction etc.	est. 25,000/mile
Fish Hatchery (Great Lakes Fishery)	
If built, located below Clarkes Hollow Dam	100,000 - 250,000
Environmental Planning	
Interdisciplinary environmental planning consultants to assist architects/ planners and engineers in secondary, draft plan preparation, including tree survey at 1" = 40'	15,000/yr
Museum	
Presumably housed in existing building on North Pickering Project Site, Secretary (included in Supervision and Coordination above), Stationery, promotional work, library	2,000
TOTAL (less stream rehabilitation, fish hatchery)	$185,000-$222,000

POLICY IMPLICATIONS

Following are a number of issues which need discussion, and early resolution.

Institutional Structure

The personnel shown in the budget estimate above could form a unit within the Corporation which might be considered as an expanded version of a more typical City Department of Parks and Recreation. It might be titled the Environmental Management Section.

The justification for this new Section with its more diversified staff is as follows:

During construction a myriad of situations will arise requiring on-the-spot supervision, guidance, conservation and restoration and management. Unless qualified resource managers are available to give this advice, the designer, contractor, builder, workman will make their own solution, often jeopardizing expensive planning and management measures previously taken, e.g. to save specimen trees, orchards, archaeological site, etc.

The Section as well could undertake some analyses which relate to storm water management, especially the water retention ponds. The water chemist could conduct the required water quality "fine tuning" which will be necessary to ensure that the storm water meets the required standards before it is introduced into the trout streams. The soil scientist could conduct soil surveys in the three planning areas, working closely with agricultural planning and leasing, and the urban-related activities related to soil erosion. The forester could control tree planting and supervise the nursery and any timber sales. The fishery and wildlife biologist could conduct stream surveys and wildlife monitoring as needed in conjunction with the more detailed planning of each neighbourhood. The recreation specialist could supervise digs in the three planning areas and encourage community interest in archaeology and local history.

The environmental planning required for detailing community design at a scale of 1" to 200' and then 1" to 40' we see being done by consultants with a comprehensive knowledge of planning, design and engineering. The Section staff, because of their intimate knowledge of the site, could simplify, at lower cost, the work of the consultants, resulting in a higher quality of integration between the environmental sciences and the engineering and design professions.

The additional focus for environmental quality on the site could be achieved by considering the possibility of organizing a regional museum, combining natural history, archaeology, 19th Century technology and historical buildings. Such a museum could link together many groups which usually have similar objectives but no common framework and/or facilities in which to pool professional talent. A museum could link both schools and the

public, becoming the vehicle for such activities as supervised archaeological digs, salvage, tree planting, stream rehabilitation. Potentially, it could serve a larger area than the new community. Established now, it would clearly define the NP's concern with quality of life issues. In the long term, the museum and an attached outdoor education centre could be either operated solely or jointly with the new community, the Region or MTRCA.

An Environmental Advisory Committee to the new community corporation would bring together citizen groups, teachers, professionals living in the area and government (MNR, MOE, MTRCA) to discuss local environmental issues. The environmental co-ordinator for the Corporation could be chairman/secretary.

MTRCA should be given jurisdiction over all valley lands and setbacks on adjacent tablelands of West Duffin Creek and the East Duffin Creek in areas of permanent base flows. In the intermittent flow zones, the new community should have jurisdiction as these zones will be more in-city "park" drainage areas. Regulation 735/73 should apply (flood and fill regulation) on all lands under MTRCA jurisdiction. The storm water retention areas should be managed and monitored by the new community in cooperation with MNR, MTRCA.

If a fish hatchery below the Clarkes Hollow Dam is established, the expertise of MNR would suggest that this Ministry operate it.

Leases of Agricultural land should include, as discussed above, provisos to restrict cattle trampling along streams and in woodlots. Allowance for pedestrian ways along drainage courses should be considered.

The dams proposed on the West and East Duffin Creeks should be considered in a separate study. Fisheries management potential, relative risk from flooding, flood-proofing, and acquisition of downstream properties are all inter-related issues requiring some sophisticated engineering and cost-benefit analysis. Furthermore, the height of the dam and flow lines at Clarkes Hollow make a great deal of difference on access to the valley, fisheries potential, and loss of unique forest resources. Various heights might be considered as well.

Cold Water (Salmonid) Fishery versus Warm Water Fishery

The issue of the cold water (salmonid) versus warm water fishery in West Duffin Creek needs resolution. If a dam at Clarkes Hollow is constructed, a bass/rainbow combination fishery would be a logical one for the reservoir, assuming that the water is deep enough and sufficiently oxygenated in summer to support trout. Though this does not strictly conform to the earlier articulated goal of having a salmonid fishery on all tributaries of the Duffin Creek system, it appears to be a reasonable alternative likely to be accepted by the public, MNR, MOE, MTRCA, Transport Canada, Environment Canada and the IJC.

Landfill Sites

The proposed landfill site at the northeast corner of the NP area (Brock Road) although not technically within the new community, offers some threat to water quality in the East Duffin Creek tributaries unless leachates are carefully controlled. The Liverpool Road Landfill site, as it is downslopes from the new community seems to offer no difficulty if leachates are controlled.

Whitevale Pond

Whitevale Pond and Mill and its raceway are a cultural/historical and recreational feature justifying complete restoration, or certainly careful consideration before abandonment. The proposed regional museum might fit in well with the village milieu, perhaps using the mill itself or an adjacent area as its focal point.

Social Integration

As the momentum of a highly technological society encourages, indeed requires, specialization, eduation and business institutions, in a feedback pattern, reinforce the diversity and intensity of specialization. For this reason, a social structure to counter the plethora of specialization and its accompanying fragmentation of experience and to foster social integration by mix of religious, ethnic, age and sexual groups is desirable. Though that mix generally is conceived of as being accomplished through the traditional cultural activities and facilities, social integration can be achieved by people interacting with, rather than being shielded from the natural environment. Although its prime concern is the protection and enhancement of the natural and historic environment, the proposed Environmental Management Section through its activities can generate social integration.

One thrust of this proposed Section could be to plan and develop recreational facilities which cut across all ages and social strata. For instance, allotment gardens, nature and archaeological clubs, appeal to a wide mix of residents as can renovating old buildings and agricultural cooperatives. Environmental conservation programmes are another approach.

Another thrust for consideration could be exposing or involving young people in a sequence of "historical experiences" which were at one time an integral part of Ontario culture. As a focal insititution, the on-site regional museum could weave together archaeological digs, the use of water-powered energy at Whitevale Pond and Mill, of early agricultural implements, the study of early architecture, of modern water quality monitoring techniques of nature, wildlife, soil management. If "future shock" is a psychological disarrangement of society, perhaps a historically-oriented education with "doing" as opposed to "seeing" or "hearing" our heritage can develop awareness and self-actuate young people.

A third thrust could be encouraging a two-way flow of skills and values between urbanites and farmers. Since the 19th Century, the movement of young people to the cities has been a one-way flow, disrupting small villages and forcing the disappearance of the "family farm". Having new community youth interacting with other ages and groups through educational activities, clubs, agricultural cooperatives and condominums in a rural environment is compatible in the context of the three planning areas.[1]

These three thrusts for environmental programmes require consideration by local groups, regional politicians, various Provincial staff and ministries and by social scientists. If environmental maanagement can become a vehicle for encouraging social integration, the idea may prove valuable to other communities.

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1 G. Jackson, Agricultural Area B, Urban Transition Zone, a memorandum, February 25, 1975.

PROJECTED DYNAMICS OF NEW URBAN ECOSYSTEM AND OPPORTUNITIES

We do not view urbanization necessarily as an evil or destructive force which will permanently sterilize land. The past extractive nature of land uses in the site area - the high grading of woodlots, grazing along streams and rivers (Petticoat, East Duffin, Little Rouge), practices that have removed shade and caused bank erosion, and unreclaimed sand and gravel pits suggests respect for land as an economic resource, but limited respect for land in terms of maintaining long-term productivity.

An urban ecosystem has a social dimension - the perception of man in nature - which either allows the urban ecosystem to flourish or due to a general lack of respect and maintenance allows it to undergo slow collapse, such as erosion of stream and river banks, vandalism of trees, and desecration of archaeological and historic sites. It is a fusion of the social milieu with trees, earth and water which creates a vigorous and healthy urban ecosystem. Planning for the development of a new community site, therefore, requires a managerial approach which will recommend how to rebuild the land, how to be sensitive to the land's needs, and eventually how to commit long-term capital and manpower to achieve this harmony.

In a new community a 5-year lag in perception of the value of a natural amenity may be too long. When forest ecosystems are stressed suddenly from construction, cutting or a drainage change, immediate underplanting, edge closure, insect control, or reduction in biomoss may be required. Long-term delays in perceiving the problem, mobilizing men and budgets simply may not do. It is alert local citizens and interest groups who must be willing to press for and be willing to pay for high-level ecosystem management; before these groups are firmly in place, the North Pickering team must provide the leadership, capital and technical skills to conserve and to rebuild an ecosystem exhibiting both diversity and productivity.

APPENDIX I

Environmental Quality Goals

The basic goal established by the environmental planning team was "to enable planning and development of the North Pickering site to utilize to the fullest extent the existing and potential variety of the natural and cultural aspects of the site". This primary goal and following objectives are modified from an earlier Plantown document.[1] The general agricultural and open space sub-goals will be covered in other sections.

To achieve this basic goal, the following natural and cultural systems were identified with corresponding objectives:

1. Aquatic-Biotic

To establish and maintain surface water quality capable of supporting
a) rainbow and brook trout (migratory) in the East Duffin Creek Tributaries
b) rainbow trout (migratory) in the West Duffin Creek
c) bass and perch in the Little Rouge River.

2. Hydrological

To maintain natural stream flow and groundwater regimes by minimization of development influences on run-off and water table such as peaks, surges, point loading, sediment transport, low flow period drawoffs, irrigations, excavations, and chemical pollution.

3. Terrestrial - Biotic

To maintain wooded and natural areas listed, in the following priorities, as a
a) protection base having the attributes of slope stability and hydrologic control, ecosystem maintenance for linkages and continuities of flora and fauna, production of natural woodland products and micro climate stability;
b) recreational/educational resources;
c) visually aesthetic features.

4. Geological and Land Form

To provide for land form and sub-soil integrity such that
a) protection of permanent land features such as the valley lands and the Lake Iroquois shoreline;
b) groundwater recharge potential;
c) protection from hazard lands;
d) aesthetics and uniqueness;
e) resource (sand, gravel, groundwater) protection;
f) educational and recreational potentials are realized.

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1 Environmental Planning: An Approach to Environmental Analysis, Plantown Consultants, Appendix AV1, October, 1974.

5. Climate

(a) To ensure development is compatible to man-made noise and air pollution effects due to road, rail and air traffic.
(b) To maintain valley systems as circulation zones.
(c) To establish and maintain air pollution standards (as defined by MOE in reaction to concepts and as integrated with standards of MTC).

6. Cultural-Historical

To maintain a cultural and historical continuity on the NPP development area by preserving significant traces (or the ambiance) of the past (both as educational and practical artifacts useful for present and future development), parts of which shall include;
- architecturally significant buildings;
- significant archaeological sites;
- sites associated with historical events and persons;
- key areas including Whitevale and Whitevale Pond, Green River, Cherrywood, Locust Hill, Glenn's Glen, Thompson's Corner, Concession Rd. 5, east from Whitevale, Cedar Grove, Mennonite settlement area.

7. Urban Agricultural

To integrate agricultural uses with other types of development such that zones for intensive and extensive agricultural pursuits may exist, recognizing the following features and opportunities:
a) prime land
b) capital intensive agricultural activities
c) employment for local people
d) constraints of airport, hamlet and future development
e) sludge disposal
f) educational resource
g) allotment areas
h) historic hamlet roles
i) farm community (Mennonite)
j) landscaping products - flowers, trees

APPENDIX II

Environmental Assessment, Phase IV

Impact on Abiotic Resources

A. Air Quality and Climatology

Disadvantages

1. The major road network is orientated on a north to south, east to west axis. However, aligning the network on a northeast to southwest line with a 45 degree rotation, would facilitate ventilation of summer air pollutants, particularly from automobile exhaust, and allow plantings and berms to block prevailing cold winter winds. Detailed information on wind roses relating to extremes of temperature is presently being computed by the Atmospheric Environment Service for the NPP; this information should be available shortly for wind tunnel testing and snow modelling analysis.
2. The road network requires numerous crossings of the West Duffin Creek valleys and tributaries of the East Duffin Creek. If the two West Duffin crossings are designed as low-level crossings on fill, they would impede cool air drainage down the valley, increasing the incidence of fog and trapping auto exhaust fumes. If the proposed high dam is built, these effects will be unimportant. High-level crossings on pylons will maintain cool air drainage.

Advantages

1. As to industrial location, there is no major impact as the community is upwind. The major noise and air pollution producing elements, such as the proposed airport, the CPR tracks, and the proposed highway 407, are adequately screened from residential land-use.

B. Ground Water Regime /System

A letter from U. Sibul, Chief Water Quantity, Hydrology and Monitoring Section of the Ministry of Environment, concerning potential effects of Phase III, Plan 1A Development on the ground water regime is the basis for the following discussion.* Mr. Sibul stresses the fact that there is

* W.M.C.Wilson, personal correspondence from U. Sibul, Chief, Water Quality, Hydrology and Monitoring Section, Water Resources Branch, Ontario Ministry of the Environment, February 12, 1975.

insufficient information regarding water table configurations and depths and shallow aquifer systems at specific sites. Several of his statements are paraphrased below.

Disadvantages

1. Alterations in ground water chemistry due to urban activities, such as highway salting, gasoline or liquid waste spills, and over-fertilization of lawns, could affect parts of the shallow water table system. Probably these effects would not be widespread.
2. Extensive urban development on the sand and gravel areas in the east and southeastern parts of the plan area would hinder maximum utilization of the area for recharge of precipitation into ground water. Decreased flow in local streams, particularly in the critical summer months, may reflect lack of recharge. The disadvantage could be overcome by leaving the area in open space or agriculture, although a certain amount of recharge can be retained by minimizing paved areas and using gravel pits for soakage areas, provided the water quality is high.
3. The committed Liverpool Landfill site may introduce toxic leachates into the ground water system. This situation should be avoided.

Advantages

The plan does not seem to present any serious water quantity or quality conflicts with respect to the deep aquifer. The large sand and gravel pits west of Brock Road have been left in open space.

C. Surface Water Regimen/System

Disadvantages

1. The selected development concept dissects two watershed - West Duffin and East Duffin Creeks - both high quality streams. Consequently, storm drainage will require sophisticated engineering to reduce water quality deterioration in these two creeks.
2. The steep slopes of these two watersheds will generate greater runoff, compounding the problem cited above.

3. The proposed medium and high density and the main centre at the southern end of subcatchment A-12 will generate storm drainage deterioration of Deckers Hill tributary. It would be advisable to relocate the high and medium density as well as the town centre to the south in the northwestern corner of subcatchment A-13 to take advantage of gravel pits for storm water renovation. Low density housing, perferably of the cluster type to maximize the buffer zone around Deckers Hill tributary, would help maintain water quality.
4. The Town Centre's storm drainage will negatively affect West Duffin Creek and the proposed Clarkes Hollow reservoir. To minimize this negative effect, storm water from the Town Centre (either the first "flush", which is the dirtiest, or all of it) could be diverted directly into the sanitary sewer system. Or all development of the Town Centre could be confined within West Duffin subcatchment B-16, as shown on the concept map. The storm drainage from the Town Centre would take a southerly direction and be diverted into the southern tributary of East Duffin subcatchment A-13 to take advantage of the large storage and renovation capacity of abandoned gravel pits. Or a third possibility may be to utilize the West Duffin river terraces for storm water renovation, provided that they are suitable for such a purpose and are not flooded by the proposed reservoir.
5. The high quality Whitevale Golf Course tributary of West Duffin Creek and associated high quality vegetation will be severely impacted by storm drainage from subcatchment B-15. Consideration should be given to determining the feasibility of utilizing the abandoned gravel pit northeast of Whitevale as a retention and renovation area.
6. The low and medium density housing in the southern area of West Duffin subcatchment B-14 will drain into West Duffin Creek and the proposed reservoir. However, it may be possible to use summer storm drainage from this area for golf course irrigation.
7. Drainage from the industrial areas in East Duffin subcatchment A-07 will deteriorate the East Duffin Creek. This storm drainage should be diverted into subcatchment A-09 to take advantage of the major storm water retention area west of Brock Road.

8. Storm drainage from the industrial areas in the East Duffin subcatchment A-13 and A-10 will deteriorate East Duffin water quality. As there does not seem to be any potential for renovation of industrial storm drainage in subcatchment A-10, alternate sites should be investigated to maintain water quality objectives. If such sites are not within the NPP area, then other areas in the Regional Municipality of Durham should be located to balance out the Regional assessment. It may be possible to utilize the abandoned gravel pits above the Lake Iroquois shoreline as storage and renovation areas for industrial areas in subcatchment A-13. Unfortunately, the concept plan has allocated low density development and transportation uses for these potential storage areas. Too rigid application of the "work-live" community concept could result in irreversible damage to the sensitive aquatic ecosystem.
9. The committed Liverpool Landfill site may poison the water in the several springs draining the area into the A-13 tributary. Toxic leachate from the landfill should not be allowed to enter the ground or surface water system.
10. The two road crossings of the West Duffin Creek will have detrimental effects on water quality, both during construction and operation. Storm water from the bridge and road should not be permitted to drain directly into the river.

Advantages

1. The development concept generally avoids impact on the high quality tributaries of East Duffin Creek north of concession 5. If storm drainage from industrial areas south of concession 5 can be controlled, impact should be minimal. Improved waste management at the mushroom factory would undoubtedly affect water quality favourably.
2. Storm drainage from Town Centre development can be easily diverted from the high quality Whitevale golf course tributary.
3. Several of the potential storm water renovation areas have been left as open space reserves. However, consideration should be given to retaining key remaining areas, if water quality objectives are to be realized.

D. Landforms

Disadvantages

1. The topography exhibits numerous moderate to steep slope areas which present development constraints for servicing, roads, and housing which must be considered in the design level.
2. The Lake Iroquois shoreline is dissected in four places by roads. The major arterials east of the proposed lake and paralleling the CPR tracks west of West Duffin Creek are the worst offenders. Some opportunities exist for providing lay-bys for drivers wishing to enjoy the view south to Lake Ontario. Further, the low and medium density residential designations above the shoreline, east of the proposed lake, will inhibit enjoyment of the view as hikers would be confined to the slope, making walking difficult. An easement of at least 50 to 100 feet on top of the shoreline should be reserved for public use.
3. The drumlin-shaped hill east of Brock Road is preserved, but is surrounded by industrial uses and severed from the rest of the community. The hill has potential for tobogganing or a childrens' bobsled run, particularly the south-east facing slope. As this potential is restricted by industrial uses and a regional transit line at its base, setback of at least 100 feet from the base of the slope would be desirable. The large employment area south of the hill, located on a boulder pavement would detract from the hill top view southwards to Lake Ontario.
4. The Town Centre and residential areas are located near the West Duffin Creek valley, requiring careful control of people to avoid erosion and slumping from recreational use. The rising lake level and intense use of the slopes of the proposed lake would accelerate slope instability, which, in turn, would become a safety hazard.
5. The high density housing designation of 22 acres northeast of the proposed reservoir does not respect the 4:1 setback limit. In fact it is shown encroaching on the slope; development should be restricted at least 500 feet from the bank.

Advantages

1. Most of the prominent sections of the Lake Iroquois shoreline are respected.
2. Most of the steep slopes in the river valleys are maintained in open space.

7.3.2 Impact on Biotic Resources

A. Agricultural Production

Disadvantages

1. The large orchard on the tableland east of Clarkes Hollow is to be developed by all residential densities and a main centre. Given the trend of disappearing fruitlands in Ontario, the orchard should be allowed to continue in production. At any rate, if the orchard is to be developed, as many apple trees as possible should be preserved in the low and medium density residential areas. (Note: Though agriculturalists will discuss this in detail, the disadvantage above should be noted in the context of total environmental impact.)

B. Forestry

Disadvantages

1. The high quality woodlot 4F-3 containing sensitive hemlock may be affected by the proposed road on the northwest side because of air pollution and salt spray. This road should be located approximately 200 feet to the west to follow the ridge line thereby lessening the need for salt use.
2. The medium density use surrounding sensitive woodlot 4F-3 may cause stand deterioration as a result of human foot traffic. Low density housing is preferable in this area.
3. The sensitive hemlock stands in woodlots 4F-3 and 3F-1 will be affected by alkaline storm drainage if the Whitevale Golf Course tributary is used for storm discharge.

4. Air pollution from industrial development located adjacent to the McLaughlin Woods (4H-6) may contribute to deterioration of senstive stand species such as hemlock and white pine.
5. The proposed Clarkes Hollow reservoir will require removal of forests in the valley. The extent of forest removal will depend upon the operating level of the dam.
6. The Steeles Avenue extension over the West Duffin Creek would require cutting into Woodlots 3G-3 (west bank) and 3G-2 (east bank). Both have a high percentage of maple, with some cedar, beech, and hemlock.
7. The major arterial crossing of the West Duffin near the CPR tracks, will cut into Woodlots 3G-5, 3G-7 and 3H-6.

Advantages

1. The Town Centre has been located sufficiently to the east of the sensitive hemlock stands along the West Duffin Creek banks to avoid major deterioration. The effect of the Town Centre on forestry, will be further diminished if storm drainage is excluded from West Duffin subcatchment B-15.
2. The major forested ravine systems of the site have been maintained in open-space uses.
3. The road alignment immediately south of the industrial zone appears to avoid all woodlots. However, salt tolerant species should be planted immediately to act as a buffer to protect potential mortality of sensitive species.

C. Fish and Wildlife

Disadvantages

1. Storm drainage from West Duffin subcatchments B-14, B-15, and B-16 will be detrimental to a salmonid fishery in West Duffin Creek as well as in the proposed reservoir at Clarkes Hollow unless remedial measures are taken to improve water quality.

2. Storm drainage from East Duffin subcatchments A-07, A-08, A-09, A-10, A-11, A-12, A-13 will impact the salmonid fishery in main East Duffin Creek; A-11, A-12 and A-13 will affect specifically the high quality Deckers Hill tributary, unless the drainage is stored in retention ponds where oxidization will remove organic waste and vegetation will absorb many nutrients.

Advantages

1. As the Whitevale Pond is reserved as open-space, the wildlife potential of this area is maintained.
2. The proposed West Duffin reservoir may offer the opportunity to establish a two-tier fishery consisting of trout in the bottom cold layer and bass/perch in the upper warm layer. This opportunity depends on the operational management of the reservoir, which has not been determined to date.
3. The stream and river valleys have been retained in open space ensuring abundant wildlife habitat. Provided that road crossings do not block the valleys, wildlife movement will be unimpaired.
4. The retention of several abandoned gravel pits offers potential for storm water storage to regulate stream quality and quantity for fishery objectives for possible neighbourhood fish and waterfowl ponds.
5. The forest replanting programme to accompany the New Town development will provide expanded habitat for wildlife, particularly songbirds, pheasants, and rabbits.

Cultural-Historic Resources

A. Archaeology:

Disadvantages

1. The road alignment south of the northern industrial zone may destroy the Ansell Site (AlGt29). If this is the case, salvage operations should begin immediately.
2. The railroad - road system in the northern industrial zone may encroach upon the Park site (AlGt-28). Again, salvage operations should begin immediately.
3. Site AlGs-35 on the Deckers Hill tributary midway between concession roads 4 and 5 is designated for development with low density housing and is worthy of further investigation according to William Ross, Ontario Archaeologist in a memo dated March 3, 1975 to William M.C. Wilson.

Advantages

1. The Salgo site (AlGs-27) is designated as open space by the Concept plan.
2. The Sime site (AlGx-22), identified for further archaeological work by Konrad, is within the designated open-space reserve around Whitevale.
3. The transportation system north of Green River appears to avoid the Pennock site (A-Gt-55) and the Smitham site (AlGt-64).
4. The Liverpool Landfill site in the Parkway belt misses the Miller site (BaGh-5) which has yielded significant information on the prehistoric culture of Pickering man.*

B. Historic Buildings:

Disadvantages

1. The proposed highway 407 alignment will remove several historic buildings located along present highway 7. These buildings could be moved to the Whitevale - concession road 5 area.
2. Four historic buildings along the Clarkes Hollow Road and one building on Brock Road will be disrupted. These buildings should also be moved.

* The Miller Site, Walter A. Kenyon, ROM, Occasional paper 14, 1968

Advantages

1. The unique character of Whitevale has been recognized by provision of an open space reserve around the historic village. Hopefully, some architectural and design controls (to avoid mixing architectural styles) can be developed for the adjacent low density areas around the village.
2. The concept plan has also preserved the special character of concession road 5. It is suggested that infill of endangered architecturally/historic buildings from other areas of the site be located along concession road 5.
3. The historic village of Brougham has avoided major impact by routing transportation routes to the north, south and east and designating open-space around the village.

C. Aesthetic and Open Spaces:

Disadvantages

1. The proposed lake would flood a river valley having a high aesthetic value causing the following disadvantages: a) as the dam would be 120 feet high, it could be unsightly, if not designed carefully; b) water quality in the proposed reservoir may or may not be good. If the valley were to be flooded without prior cutting and removal of trees, the abundant stumps and snags will inhibit for some years recreational use, except perhaps for bass fishing; c) assuming the lake were a successful recreational facility, there would be some visual intrusions from the Steeles Avenue extension over the lake and possibly from the high density residential area northeast of the site; d) if the two HEPC lines across the valley were not relocated, their presence would detract from the amenities of the lake and pose a safety hazard; e) the oil pipeline crossing the valley in the flooded zone may require relocation. The possibility of an oil spill, however remote, must be considered; and f) other issues concerning the lake have been discussed in greater detail in Appendix X.
2. The Lake Iroquois shoreline is partially respected, although further reserves are necessary to preserve its integrity. Higher building heights, should be graded from south to north in order to keep the view to Lake Ontario "open" to as many residential units as possible.

3. The major arterial roads paralleling the CPR tracks over the West Duffin Creek valley and the Steeles Avenue extension would require massive cut-and-fill if they were to be low-level crossings. Not only would these have a visual impact on hikers walking the valley, but be a physical obstacle as well. Providing a pedestrian underpass or tunnel in the fill or supporting the bridge on pylons would be a solution. A high-level crossing would dwarf the valley and totally destroy any sense of "wilderness". The highway noise and exhaust fumes would be quite noticeable.
4. South of the HEPC Gatineau line a minor arterial is shown linking Liverpool Road with the major arterial crossing the West Duffin Creek, just north of the CPR line. At the Liverpool Road connection, the Jesuit Spiritual Renewal Centre called Manressa is severed. The severance, hopefully, is a draftsman's error.

Advantages

1. The proposed lake is potentially a very positive landscape feature near the New Town. Providing the reservoir has good water quality, is free of troublesome siltation at the north end, is prepared properly before it is created, and can be managed for recreation and sports fishery, it can provide an unique recreational and amenity resource for the new community.
2. The open space designations utilized the river valleys and the other natural features to provide a good linkage between recreational nodes, educational institutions, and main centres. This linking provides a viable alternative to the automobile, in turn, a factor which improves the overall environmental health of the new community.
3. The plan maintains many of the existing recreational and open-space areas, such as the Whitevale Golf Course, the Pickering Golf Course, Camp Pidaca, and the Whitevale Pond.

Summary

Disadvantages

Storm drainage from the proposed development will deteriorate water quality in the West Duffin and East Duffin Creeks. However, site features such as abundant gravel pits and river terraces may offer opportunities to realize the water quality and aquatic-biotic goals of a cold water salmonid fishery in the Duffin watershed.

Advantages

1. Less prime agricultural land is utilized by locating the concept plan on the east portion of the NPP site.
2. The stream and river valley systems have been maintained as open space corridors, offering potential to develop open space linkages throughout the new town.
3. The overall preservation of landform integrity within the NPP site particularly of the Lake Iroquois shoreline, affords possibilities to link the new town development to off-site recreational areas such as the Metro Zoo site, the proposed ski hill at the Beare Landfill site, the proposed regional park north of the Zoo site, and the proposed winter recreation area in the Liverpool Landfill.
4. The unique historical/architecutral character of Whitevale and concession road 5 has been recognized.

APPENDIX III

Potential Dam and Lake on the West Duffin

MTRCA supports the construction of a dam on the West Duffin Creek for flood control purposes. The tentative location chosen by the design team for evaluation is northeast of Dixie in the approximate position of the old Lake Iroquois shoreline. Two other locations were suggested in a 1963 report but present knowledge indicates the Dixie location is the most feasible. At this time little is known about the operation of the dam and lake: retention time, quality of water, effects on downstream users, and natural features, specifically the marsh at the mouth of Duffin Creek, and the basic question whether management of the dam will be single or multi-purpose. Tentative proposals show that the dam will be constructed to a height of 490 feet asl,and designed for capacity requirements of a "Hurricane Hazel" storm (474 feet asl). The Creek is 370 feet asl. The normal operating lake level would be at 430 feet asl. The storage volume at 474 feet asl is 10,100 acre feet, and approximately 3,000 acre feet at the lower level of 430 feet asl. Assuming the above specifications, certain constraints and opportunities for the NPP site can be identified.

1. Vegetation

At 430 feet asl most of the vegetation to be flooded would be cedar in Woodlots 3G-5, 3G-7, 3G-4, GF-5, and 3F-6. At 474 feet asl affected vegetation includes the high quality hardwoods on the steep slopes of the valley in Woodlots 3G-2, 3G-3, 3F-2; the high quality units with hemlock in 3F-4, 3F-1; and cedar on the upper terrace at Clarkes Hollow in 3F-3.

Provided retention time at the high level of 474 feet asl is no longer than 24 to 48 hours during the growing season and the water of good quality, many of the flooded species can survive. During the dormant period, longer length of flooding is permissable. Whatever level the reservoir is operated at, many trees 4 to 6 feet higher than lake level will perish because of a change in water chemistry or flooding of the root zone. For example, hemlock requires a soil pH less than 6.5. Since the pH of the West Duffin Creek is in the

vicinity of 8.7* ,mortality of hemlock trees from alkaline water in the soil can be expected. Some mortality of hard maple, beech, red oak, and other hardwoods whose root zones are between the new lake level and 4 to 6 feet above that level also can be expected. Cedar and soft maple are more tolerant in this 4 to 6 foot zone. A forester should be consulted to supervise cutting.

As there are no lists of herbacious vegetation, it is not possible to assess potential losses of unique or endangered plant species. A trained botanist should be consulted for a detailed examination of the field sheets for the original biological survey of an inventory of plants in order to salvage significant species.

Trees lower than 430 feet should be removed; otherwise recreational use of the reservoir will be restricted for the first 10 to 15 years by stumps and snags; water quality will be affected by their decomposition.

Salvage of any significant plant or tree stock for replanting can be done. Economic use of trees cut in reservoir area is possible. There are many cedar posts potentially salvageable. Replanting above the flooded zones can improve the general aesthetics of the proposed reservoir.

*F.A. Walden and M. Griffiths. A Biological Survey of North Pickering Site...,Ontario Ministry of Housing. Appendix IV, Table 4, p. 299.

2. Wildlife

The flooding will destroy the habitat required by some existing wildlife species found in the Duffin Creek valley. The animals and birds will migrate as the water level increases or as the trees are cut down. Impact on mammals is highest.

The lake and reservoir provides a potential for attracting new species or improving the existing water-related habitat for waterfowl. The upper terrace could be used for nesting of mallards and teal. Although waterfowl are an aesthetic feature, their feces, high in nutrients, encourages plant growth (eutrophication); for this reason numbers in the hundreds should not be encouraged.

3. Fish

There is insufficient information on existing fish species in the affected portion of the West Duffin Creek, but there have been indications that brook and rainbow trout may be present, at least in the cooler fall period. A detailed investigation of the existing fishery in the area of the proposed reservoir would be helpful. The downstream effects of the dam on fish could be severe: the dam will block fall migrations of trout (and the salmon proposed by MNR), unless provision is made for fish ladders; and for a distance downstream the warming and low oxygenation of the water released may be sufficient to preclude the presence of trout and even some warm-water species. Depending on the type of fish species to be encouraged in the reservoir, the problem of preparing spawning bed arises. The question of cold water and/or warm water fishery or the possibility of a bass-rainbow trout fishery in the reservoir and a hatchery below the dam for salmon/trout needs examination. The hatchery would be the terminus for Lake-run salmon, and trout survival.

4. Water Quality

Fish survival is highly dependent on expected water quality in the reservoir. Certain changes as in pH, BOD, temperature, and siltation from upstream construction and unstable valley banks will affect fish as well as the recreational potential of the lake. Depending

on the depth of the reservoir, thermal stratification may occur, thereby making a cold-water fishery possible.

Providing high water quality depends on a great many factors, such as upstream uses, low retention time, proper preparation of the reservoir site to avoid organic loading, special treatment of the storm water issue in the New Town site. Without water quality management in the context of the whole watershed, the lake could be more of a negative or neutral rather than a positive feature on the site.

5. Bank Stability

The valley of the West Duffin Creek in the vicinity of the reservoir is deep, the river having eroded the valley walls on outside bends to produce several dramatically exposed banks up to 120 feet high with 75 percent slope. Flooding the valley to a level of 430 feet asl. will cut the toe of these exposed banks causing further slumping. With the slumping and water action, sediment will be deposited in the reservoir leading to loss of storage capacity and to deleterious effects on fish. Periodic dredging will be necessary. Further, the tableland behind these unstable banks will slowly collapse into the reservoir, similar to the condition of the Scarborough Bluffs.

Thus banks must be stabilized prior to flooding. Generous setbacks must be enforced. If the level of the lake comes to 474 feet asl, the erosion and slumping problem would be accelerated. Wave action from motorboats also could aggrevate the problem.

6. Recreation

An operating level of 430 feet asl would retain water as far as the existing Clarkes Hollow bridge. Due to the steepness of the valley walls, there is no extensive area suitable for recreational access. Other than on a terrace at Clarkes Hollow, which has homes and cottages, there is insufficient land for onshore facilities, such as parking, concessions, and picnicking. The existing road access to the terrace could be maintained, but improvement and widening may be necessary.

In addition, the reservoir may be too shallow at this site for boat access if the siltation process, which is usual at the top end of such reservoirs, fills in the lake; but swimming, wading, canoeing and row-boating may be possible activities. Another access point could be at a small area of 6.5 acres on the east side of the Creek, south of Wood-lot 3F-5, that would not be flooded at the 430 foot asl level. This area would be accessible from the HEPC and oil pipeline right-of-way down a slope of 21 percent. Some cut-and-fill would be necessary. At this site depth of the reservoir would be about 20 feet. A third access point could be built at the dam where a road on the top of the dam would provide access and a valley crossing.

Whatever access point or points are to be used, it must be designed to be flooded by a "Hurricane Hazel" sized-storm. Such potential flooding precludes expensive concession buildings, but not boat ramps, parking areas, and picnic tables.

Should an operating level of 474 feet asl be chosen, these three access points would be flooded, and the reservoir would extend as far north as the Whitevale Golf Course. The steep valley walls hinder access. One access possibility, not as large a site as the southern terrace, is at the terrace of Clarkes Hollow, north of the road and west of the Creek. This access point, however, would require special design.

MTRCA will manage the dam and reservoir, presumably with flood control being the prime purpose. The lake will be a regional facility although residents of the NPP site may confuse its identity with their New Town. Their expectations may be that recreation is to be the ultimate purpose of the dam and reservoir. This potential conflict in management purposes should be recognized prior to choosing to build the dam and fixing its operating level.

7. Indirect Effects

Weather modification evidenced by the increased incidence of fog (having implications at bridges over the water) may be expected near the water, especially for low-level crossings. The height of the dam,

(490 feet asl) some 55 to 60 feet above the proposed 434 foot level, would reduce cold air drainage. This reduction is not particularly serious as long as air pollutants do not build-up in the valley from heavy highway traffic. The West Duffin Creek valley is believed to be a ground water discharge zone. Ground water now seeps out of the valley walls in the reservoir area. Flooding the valley will intercept ground water higher up and lessen the gradient of the water table. It will as well develop a hydraulic head of some dimensions; the sand lenses appear to be too fine to have high transmissibility but this factor needs careful geological and engineering evaluation.

Appendix IV

WATER MANAGEMENT AND HYDROLOGIC MODELLING

As mentioned above, special consideration was required to minimize environmental impact upon existing water quality and quantity conditions in the natural watercourses of the planning area. To obtain an idea of the magnitude of this problem, professional hydrologic engineering expertise and judgement was used and three computer modelling techniques were generated to simulate urbanized conditions in the planning area.

The first computer modelling technique used was a spatially distributed model using finite differences, routing and data bank techniques.[1] Development of this model resulted in a determination of the processes of runoff generation in generalized terms. On the average, in time and space, precipitation in the area of the North Pickering Project is about 30-32 inches per year, the runoff about 8-12 inches per year (larger for the Duffin and less for the Rouge), the evaporation about 20 inches per year; about 1-4 inches of percipitation probably reaches Lake Ontario as groundwater. This was the Project's first indication of the necessity to further study groundwater as a component of the hydrologic cycle.

The first application of this model to modified or urbanized

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1 A Hydrologic Model for Environmental Impact Assessment in the Rouge, Little Rouge, Petticoat and Duffin Watersheds, Sully I. Solomon & Associates Ltd., for North Pickering Project, Ministry of Housing, March 1974.

environmental conditions provided valuable initial information. Two parallel model runs were conducted one for the basin under current conditions and one for the proposed developed basin for small and moderate storms (.1-1 inch in 24 hours) to illustrate the nature and size of changes to be expected for these moderate storms. Flow increases of up to 1,000%, velocity increases of almost 100% and groundwater recharge reductions of about 30% were obtained. However model runs for the two sets of conditions and an extremely large storm (8 inches in 24 hours) following a rainy period,indicated smaller changes, since under saturated conditions and for large precipitation inputs, the infiltration losses are relatively small and high velocities reached usually in the drainage systems of developed areas are also reached in natural conditions. It was concluded that the development in the area will effect mainly the low or moderate flows from minor storm events, and less the very high flows from major storm events (25 year events). Frequency of high flows will increase, but not nearly as much as the frequency of moderately high flows.

With this knowledge, close attention was paid to the one-, five-and ten-year storm events as being most significant, from an environmental impact point of view. The second less expensive computer program technique (FROUT) was used to calculate increases in peak flow for a five-year storm event of a specified rainfall distribution.[2] The results of simulating a preliminary development plan showed up to 163%

2 Hydrologic Effects of Urbanization for the North Pickering Community, Plantown Consultants Ltd., April, 1974, p.4.

increase (sub-catchment area A-13) in peak flows in the Duffin Creek drainage area.[3] Further use of this second technique as applied to the Modified Phase 3 Concepts showed an average percent increase in peak flow of 93.5% for the nine effected sub-catchment areas.[4]

The importance of maintaining water quality was supported by data which indicates in general that urban run-off has a higher pollutional load than rural run-off.[5] To consider water quality adequately in conjunction with water quantity, a third computer technique was developed, termed STORM. Total pollutant loading for five selected parameters (BOD, suspended solids, nitrogen, phosphate and settleable solids) for each watershed due to each type of development were hypothesized. This particular analysis assumed that it is equally important to preserve the water quality in each of the three drainage areas and, therefore, is probably the most significant analysis on which preliminary screening and decision making may be based. Using this modelling technique, fourteen development alternatives were simulated for their impact upon the water quality. Of these, five development alternatives were located east of the West Duffin and were, therefore of most interest. Resulting analysis showed that impact could be minimized by lessening the amount of industry in sub-catchment areas A-9 and A-10.[6]

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3 Ibid, p. 1, Table 4.
4 Hydrologic Assessment for the Phase III Modified Concepts upon the Watershed Systems associated with the North Pickering Project, J.F. MacLaren Ltd., December 1974, Table 1-C.
5 Preliminary Analysis of Water Resources Impacts of Urbanization on the North Pickering Community, J.F. MacLaren Ltd., March 1975, pp. 2-3.
6 Ibid, p.35.

Effect of Storage and Treatment

Storage is necessary to regulate the flow and pollutant loading reaching the stream during a period of runoff in order to control the quality of that stream and, particularly, to control the first flush in which the pollutant concentrations are typically a maximum. Very high levels of storage would contain the runoff from all but the heaviest storms, but the land required for this purpose would certainly make such an option economically undesirable. If there is no storage, it is difficult to maintain an acceptable water quality in the stream. The volume of storage required may be reduced if treatment is used in conjunction with the stored volume, but high treatment rates are characteristically costly and economic studies have shown that it is preferable to increase storage volume rather than treatment rate to minimize overflow volumes.

APPENDIX V

ENVIRONMENTAL QUALITY CONTROL GUIDELINES

Goal

The goal of the environmental quality control guidelines is to minimize the adverse environmental impact of construction activity on the land. Through the use of simple procedures and practices as outlined here, the builder is guaranteeing the value of his product by *protecting the amenities and real value of the natural environment* (which have recommended this site for homes in the first place) and by insuring architectural control.

Guidelines in the Development Process

The following steps proceed from the master planning stage (derived from the Official Plan of North Pickering Planning Area) through plans of subdivision phasing to construction phases and restoration. *Guidelines and practices specifically related to the natural environment are italicized throughout.* The first eleven steps of the environmental quality control process are by and large the responsibility of the North Pickering Corporation[1] (hereinafter referred to as the Corporation). The following steps, twelve through sixteen, are the responsibility of the builder. Step seventeen is the responsibility of the Corporation.

1. Secondary or Master Plan

   The Corporation shall prepare a secondary or master plan for development areas as a first step in detailing the

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1 For purposes of simplicity these guidelines assume only one specific relationship between the Corporation and the Developer--one in which the Corporation has a relatively major role.

Official Plan. *Such secondary plans shall include environmental features and associated protection measures. These shall include:*

a) building set-backs from the valleys
b) woodlots
c) linked open space corridors
d) ponds
e) marshes
f) watercourses
g) archaeological sites
h) architectually significant buildings
i) historical sites
j) topographic contours
k) major landforms
l) ground water sources, e.g. shallow aquifers, some springs, etc.

2. Approval of Secondary Plan

The Corporation shall secure approval of the secondary plan.

3. Boundary Survey Plan

The Corporation shall prepare a precise boundaries survey plan for each area to be developed in a draft plan of subdivision.

4. Draft Plan of Subdivision

The Corporation shall prepare a draft plan of subdivision which shall use as a base the secondary plan and a boundary survey plan. *Plans of subdivision shall include all environmental features as in the secondary plans.*

5. Approval of Draft Plan of Subdivision

The Corporation shall secure approval of the draft plan of subdivision.

6. Final Plan of Subdivision

The Corporation shall prepare a final plan of subdivision. *All environmental features shall be shown as permanent features of the base maps as in the draft plan of subdivision.*

7. Stake-out

The Corporation shall stake-out all protected environmental features (such as trees,[1] *woodlots and setbacks from valley lands) using a snow fence of distinctive colour or other delineating device. Salvageable trees shall be removed by the Corporation from those areas to be cleared.* Other protected elements of the final plan of subdivision will be staked-out.

8. Registration of Final Plan of Subdivision

The Corporation shall have the final plan of subdivision registered.

9. Engineering Services and Design

The Corporation shall proceed with engineering services and designs and their necessary approvals.

10. Contract Award

The Corporation shall award a general contract to a builder to proceed with the final registered plan of subdivision.

11. Site Base Mapping

The Corporation shall provide access to base map material which shall include all environmental features, for purchase and use by the builder. All site plans and working drawings should be done by the builder on base maps approved by the Corporation.

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1 Fencing placed around trees should be placed on the 'drip line' which is the distance away from the trunk equal to the horizontal spread of the outer branches.

12. Site Information Kit

The builder shall obtain a site information kit from the Corporation containing the following;

a) a copy of the final registered plan of subdivision on which the builder's lands will be clearly marked. This plan will show the proposed uses and the dimensions of the builder's holdings as well as those of the surrounding lots, blocks and lands within 35 metres.

b) a set of drawings which include:

i) engineering drawings showing watermains, storm and sanitary service locations with all appertainences and lot grading;

ii) hydro distribution plans including street lighting information;

iii) plan showing location of all easements.

c) a summary of proposed zoning by-law requirements pertaining to the builder's lands;

d) a copy of special conditions attached to plans of subdivision by Central Mortgage and Housing Corp. where applicable to certain blocks and lots;

e) a drawing indicating streetscape elements including increase back requirements, etc. entitled "North Pickering Corporation Development Concept" for the appropriate area ;

f) *a copy of Construction Practices and Procedures with Regard to Environmental Quality Control.*

13. Stage 1 Approvals - Preliminary Building Plans

The builder shall submit to North Pickering Corporation for approval two copies of the preliminary plans for all building types he is proposing for his land. The

preliminary building plans should indicate the following information:

a) names and telephone numbers of the builder and the architect;
b) all floor plans and elevations drawn to 1/8th of an inch or 1/4 inch to 1 foot scale depending on the size of the project.
c) a list of all exterior building materials including colours and textures.
d) a list indicating the numeric breakdown of the various housing types proposed.
e) *the proposed arrangements by the builder with private nurseries for delivery of trees for restoration. Species of trees and shrubs should be noted by the builder.*

14. Stage 1 Approvals - Preliminary Site Plans

In order to achieve the goal set out in the preamble of this manual, North Pickering Corporation will be reviewing the site plan proposals in order to create an attractive environment *with proper regard to the natural environment*, spatial relationships between buildings, location of driveways, height of buildings, room layouts, colour and landscape features. In these matters, reference should be made to the *Construction Practices and Procedures with regard to the Environmental Quality Control* and the streetscape development concept drawing forming part of the site information package.

Site plans for groups of buildings on a particular street to be prepared by the builder's architect should be at a 1" to 40' scale and should include:

a) exact location of all buildings within the particular grouping;
b) setback dimensions
c) side yard dimensions
d) first floor elevations

e) grade elevations
f) distribution of housing types
g) samples and list of external materials giving colours and textures proposed for all houses
h) fencing where applicable
i) existing topography
j) trees to be planted
k) vegetation (e.g. trees) to be preserved on-site
l) surface drainage
m) proposals by the builder for locating materials to be stored or stockpiled such as topsoil, sod, cleared vegetation and imported fill, including interim erosion control measures.
n) a proposal by the builder detailing erosion control and disposal of excavated subsoils (using the Construction Practices Procedures with Regard to Environmental Quality Control as a basis)
o) depth of the foundations below the original ground surface
p) depth to the water table at the site
q) amount of lowering of the water table by de-watering procedures if the water table is above the depth of foundation
r) an outline of the known shallow aquifers

15. Stage 2 Approval - Working Drawings

The builder should submit to the Corporation for approval two copies of the working drawings of all proposed buildings incorporating all changes required in the Stage 1 Approval process or two copies of an acceptable alternative for consideration.

The working drawings should include plans and details normally required for construction purposes as well as a schedule of exterior materials.

16. After the site plan for any particular building has been approved by the Corporation the builder will prepare individual site plans for each lot within such groups at 1/16th of an inch to 1' scale showing boundaries curbs and curbcut, mandatory fencing, CMHC requirements, setbacks, lot and building location dimensions, driveway locations and trees to be planted.

17. One copy of each drawing submitted by the builder and subsequently approved by the Corporation will be returned to the builder.

APPENDIX VI

CONSTRUCTION PRACTICES AND PROCEDURES WITH REGARD TO ENVIRONMENTAL QUALITY CONTROL

PREAMBLE

It is the responsibility of the builder to ensure that his employees are aware of and understand the environmental construction methods outlined in this document. The site foreman and his workers have the physical responsibility for operating in the manner outlined herein. The Corporation will provide guidance in the interpretation and explanation of these criteria should the contractor require it.

The Corporation will provide supervising personnel to ensure that the following construction practices are adhered to and that the builder's plans are followed. When clarification is required, then the N.P.P. Supervisors should be consulted. They will either give clarification on-the-spot or consult other resource people.

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I *INITIAL SITE PREPARATION*

(a) *Environmental Features to be Preserved*

Trees and other vegetation that are identified for preservation on site[1] *must be avoided.*

(b) *Removal of shrubs and trees*

Exposure of soils

Construction should be planned and scheduled so the area and duration of exposed materials from clearing, grubbing, excavation, borrow or fill is reduced to a minimum. Stabilization and/or revegetation of exposed soils should be done as soon as possible. (See Table 1 for possible actions.)

It is suggested that while a single precise figure as to how much erodible soil can be exposed at any particular time, is not available, the amount (which will probably vary with degree of slope, local soil types, etc.) can probably be decided in consultation and close co-operation on a week-by-week or day-by-day basis with the NPP Supervisor.

Large trees - Trees which are cut should be stacked in piles in approved[2] *locations.*

This wood will be used, at least partially, as firewood by the local residents.

Shrubs and trees under one inch in diameter

Cleared underbrush and small trees should either:

(i) be placed in piles in approved locations on the periphery of the development; or

(ii) be chipped and spread on cleared areas of serviced land prior to commencing building, as an interim erosion control measure.

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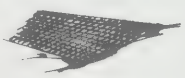
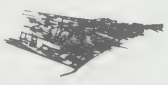
1 As detailed in Step 7 of the Environmental Quality Control Guidelines.

2 Approved locations will be determined between the Corporation and the builder at the Step 14 (m) Stage 1 Approvals - Preliminary Site Plans phase of the Environmental Quality Control Guidelines.

Table 1

LANDFORM STABILIZATION ACTIONS

Methods	Description	Transformations Affected	Decrease: Major	Decrease: Moderate	Decrease: Minor	No Effect	Increase: Minor	Increase: Moderate	Increase: Major	Application
Cultivation 	Prevention of erosive forces of water moving downhill by contour plowing (lateral furrows).	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Temporary measure requiring constant monitoring and maintenance; does not prevent wind erosion. Encourages percolation.
Planting 	Use of plant material as soil binder. Method of planting varies: 1. Planting from containers 2. Aerial seeding (large scale) 3. Hydro-seeding (broadcast in liquid mixture by machine.)	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Effectiveness dependent on species of plants, time of planting. Consideration should be given to use of natives, vs. Exotics and the need for irrigation.
Jute Mesh 	Heavy woven jute layer used as surface soil binder, often used in conjunction with planting. Rolled onto slope in strips.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Interim measure while plants become established. Will decompose in a short period of time.
Straw Cover 	Straw, broadcast over slope, then rolled into surface with sheepsfoot roller forming a compacted, bound surface.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Interim measure while plants become established. Requires monitoring and maintenance.
Rock Blanket 	Layer of rock applied to surface.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Requires much manual labour for replacement. Machinery required may cause incidental compaction
Sprayed Synthetic Material 	Chemically derived materials applied in liquid or filament form. Applied by machine.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Temporary measure, leaving residue of materials for indefinite periods. Generally hampers plant germination, and can stop percolation when applied heavily.
Degradable Sprayed Material 	Organically-derived materials applied by machine.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Temporary measure, with residue breaking down in relatively short period of time. Usually encourages germination and growth of plants.
Impervious Membrane 	Waterproof surface coating, such as concrete or asphalt.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Permanent measure, severely affecting many natural processes. Displaces animal habitats.
Windbreaks 	Plant material or structural elements to prevent wind erosion by slowing and settling airborne particles.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Incidentally alters air flow. Serves as method of landform alteration in that soil builds up around barriers in many cases
No Soil Retention	Erosion control rendered unnecessary by use of stable, natural landforms and avoidance of alterations.	Sedimentation Soil Storage Water Erosion Wind Erosion Runoff Resource								Allows natural processes to continue uninterrupted.

Source: American Institute of Planners Journal, November 1974.

NO buring of the cleared vegetation should take place.

Sod - where it exists, sod should be stripped, rolled and stored at approved sites for use in the near future in areas where soil erosion control in required under the direction of the NPP Supervisor.[1]

(c) Surface excavation - Topsoil material (to a depth of 6 to 12 inches should be transported to approved storage areas to future use within the development area. This soil must be spread on sites after final grading to facilitate in the re-establishment of vegetative cover.

(d) Excavation of Sub-soil materials - Excess materials from basements, trenches and reduced landforms be transported to approved storage locations. As this material could possibly be used to stabilize some slopes during restoration, plans for this use should be formulated prior to commencing construction.

II DURING CONSTRUCTION

(a) Interim erosion control

Procedures should be established for minimization of erosion and control of that erosion which does occur.

Slopes and slippage areas - areas with slopes of 50% or greater should be entirely avoided by construction equipment and activities because of vegetation, soil stability and maintenance considerations.

Water must not be concentrated on long slopes or slippage areas because of erosion and stability problems. This may be accomplished through the use of various types of diversions such as ditches, berms and terraces which carry the water to a safe disposal point (see Table 2).

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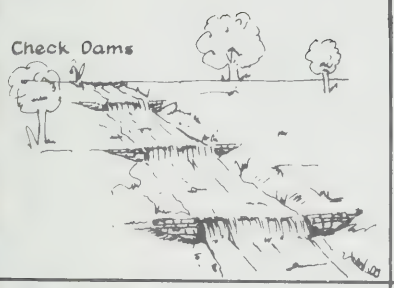
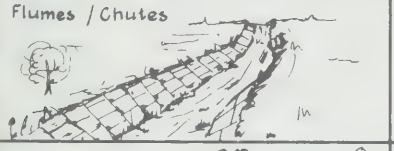
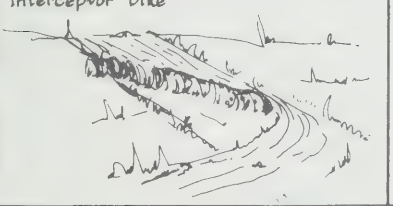
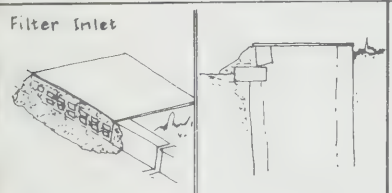
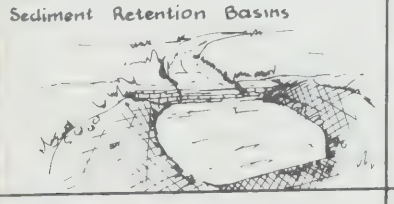
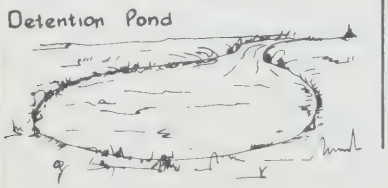
1 Supervision of storage areas is required so that sod is properly protected against drying out and too long a storage period (e.g. 2-3 days in high summer is considered a maximum). Co-ordination of the timing of sod removal and relaying and maintenance of the stockpiles is necessary for this protection measure to be successful.

Table 2

STORMWATER DRAINAGE CONTROL ACTIONS

Methods	Description	Transformations Affected	Decrease: Major	Decrease: Moderate	Decrease: Minor	No Effect	Increase: Minor	Increase: Moderate	Increase: Major	Application
Check Dams 	Are structures used in natural or artificial channels to reduce or prevent excessive erosion by reduction of velocities (head cutting & grade stabilization) or by providing partial lined channel sections or structures that can withstand high flow velocities.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used where the earth & / or vegetative measures are exceeded in safe handling of water at permissible velocities, where excessive grade or where water is to be lowered from one elevation to another
Flumes / Chutes 	Are channels of concrete or comparible material which conduct storm runoff from one elevation to another (downslope) without erosion of the slope.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used as temporary, interim, or permanent structures down slopes where concentrated runoff would cause slope erosion.
Diversion Dike 	A temporary ridge of soil constructed at the top of cut or fill slopes which diverts overland flow from small areas away from unstabilized slopes.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used as temporary or interim measure at the top of a newly constructed slope.
Interceptor Dike 	A temporary ridge of compacted soil constructed across a grade right-of-way which reduces erosion by intercepting storm runoff and diverting it to temporary outlets where it can be disposed of with minimal erosion.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used across graded right-of-way that are not subject to vehicular traffic (hydro, pipeline etc.)
Filter Berm 	A temporary ridge of gravel or crushed rock constructed across a grade right-of-way which retains sediment on-site by retarding and filtering runoff while at the same time allowing construction traffic to proceed along the right-of-way.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used primarily across graded right-of-way that are subject to vehicular traffic. Also applicable for use in drainage ditches prior to roadway paving and establishment of permanent ground cover.
Filter Inlet 	A temporary filter of gravel & or crushed rock constructed at storm sewer curb inlet structures which retains sediment on-site by slightly retarding and filtering storm runoff before it enters the storm sewer system.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used at storm sewer curb inlets.
Sediment Retention Basins 	A temporary dam or basin or a combination of both that will trap or store sediment (generated during construction activities) delivered to the structure by storm runoff.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used across channels and drainage-ways that are on, or adjacent to, construction sites.
Detention Pond 	A permanent basin or pond area which will contribute to reduce peak flows downstream.	Sedimentation Soil Storage Water Erosion Velocity Resource								Used in built-up areas to re-establish natural drainage regime to enhance amenity value of neighbourhoods.

Source: Guidelines for Erosion and Sediment Control Planning and Implentation
Report No. FPA-A-2-12-013 Office of Research and Monitoring
US Environmental Protection Agency, August 1972.

On areas of less than 50% where development activity is occurring measures should be carried out to provide temporary soil control measures. Mulches such as hay, straw, and woodchips serve to enhance seed germination. (See Table 1 for suggested methods.) Preference should be given to woodchips where disposal of unsalvageable wood presents a problem. In most cases, the mulches should be secured so that they will not be washed or blown away. For steeper slopes, netting should be used. Crimping, with specially designed machines, and tacking, involving the application of an asphalt or chemical binder, can be used in very unstable areas.

In summary all bare ground must be treated with interim erosion control measures until permanent measures are practicable.

(b) Water control and de-watering practices

Various types of material may be used for sediment retention structures where runoff is low. At inlets to storm sewers and in ditches, material such as straw bales, sandbags, and crushed stone may be used. Vegetative filter strips of thick growing grasses can also be used around storm drains to retard flow and filter out sediment. All erosion and sediment control structures should not be removed until it is assured that they will no longer have any useful purposes.

Any water pumped from the construction area for the purpose of excavation or trench de-watering should be piped into control structures or spread on nearby grassed fields if the N.P.P. Supervisor determines that it is sufficiently free of suspended solids, and other contaminants.

Control structures must be constructed to conduct run-off to lower elevations at velocities within non-scouring limits and into sediment basins (See Table 2). The latter should be designed carefully so that runoff can be regulated, and trapped sediment removed regularly to maintain storage capacity. Most importantly, care must be taken to ensure that the structure will not be destroyed during a major flood. The disposal of trapped sediment will be in an approved location.

(c) *Stream crossings*

Stream crossings, channel dredging and straightening of streams should be avoided. If such work must be carried out, timing must avoid such sensitive periods as that of fish spawning and to coincide with periods of low flow utilizing proper sediment traps and by-pass arrangements, to maintain stream life downstream.

Wherever construction activities necessitate the crossing of minor watercourses (as determined by the NPP Supervisor) temporary retention areas should be constructed with dust-free crushed gravel several yards downstream. Crossings should be at or as close to right angles as possible. Such crushed gravel retention areas will enable settling of silt caused by the movement and installation of equipment.

Crushed gravel should be used as the top fill in any stream bottom where underground installation of services has been completed (instead of previous excavated materials).

In the case of stream diversion, the banks and riverbed must be stabilized by compaction prior to the redirection of the stream to its original course. Subsequent to the redirection, the diversion channel must be filled and stabilized.

(d) *Fill storage*

Any gravel or other materials stored on site must be placed in approved location and maintained to prevent erosion. Protection of any stockpiles subject to wind erosion with plastic sheeting or other material is recommended. Trenching and ditching around the storage area and compaction of the pile and storage area is necessary to prevent water and gravity erosion. Such erosion control measures must be maintained and the site never left for the day until adequately protected.

(e) *Machinery maintenance*

No machinery maintenance is allowed in or adjacent to any watercourses or storm water sewers. All oils, fuels and other waste products and solutions resulting from equipment maintenance and breakdowns will be collected in leakproof containers and disposed of at the nearest municipal waste disposal site or re-refinery station.

Precautions should be taken to prevent spillage of oils, fuels and other waste solutions resulting from equipment maintenance. Contingency plans should be established for the rapid clean-up of spillages that do occur.

III *RESTORATION*

(a) *Permanent erosion control*

All created berms and existing slopes over 10% should be covered with topsoil (3-4" minimum) and immediately covered with adequately secured sod materials wherever service trenches and excavations do not have to be placed. In the latter case use interim erosion control measures described in Section II, (a).

On lands of 10% or less slope, the minimum restoration should include replacement of the top soil (4-6" minimum) grading and hydro seeding with a liberal application of straw materials (or other binder techniques)

after seeding to prevent erosion before germination of the seeds. Such a re-seeding program should be done only during those periods of the year when establishment of the grasses is possible (NOTE: - Consult with NPP Supervisor).

(b) *Landscaping*

The builder will arrange delivery and planting of the nursery stock[1]*. These plantings should be placed at the most favourable time of the year for their establishment (consult the Nurwery Supplier for more information).*

All necessary maintenance of the plantings (e.g. watering, spraying, pruning) for their survival is the responsibility of the builder until the property is sold.

All slopes have a suitable slope and toe created so that no future slumping will occur with suitable revegetation techniques applied.

On trenches for underground services within the development area, compaction of fill materials would be performed by the builder as an allowance for future settling of these materials.

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1 Described in Step 13(e) and 14 (j) of the Environmental Quality Control Guidelines. (Appendix V)

Ministry of
Housing

Ontario